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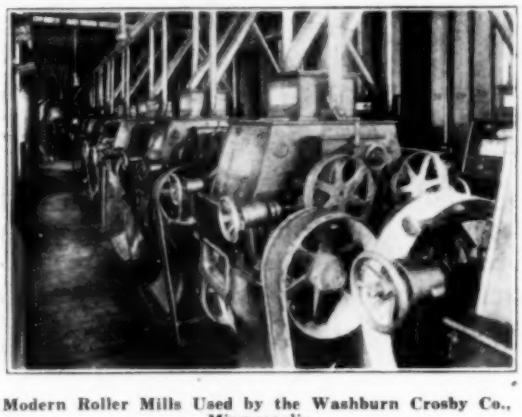
Castings Grind Flour for a Hungry World

FLOUR, made of wheat and other grains, has constituted the staple food of man since the dawn of civilization. As early as 3000 B. C., the Chinese were growing wheat, and evidences that this grain was cultivated has been found in some of the most ancient ruins of Europe. The flour milling industry first was introduced into the western hemisphere in a French colony in Nova Scotia in 1605.



Modern Roller Mills Used by the Washburn Crosby Co., Minneapolis

The industry spread along the Atlantic seaboard as the colonies were established until Baltimore, with excellent water power facilities, was the center of the industry late in the eighteenth century. Before that time the milling process was extremely laborious, but in 1785, Oliver Evans introduced the elevator and conveyor. Developments in design of milling machinery have increased the number of castings used, until today the machines are built chiefly of cast parts. Flour and grain mill machinery manufactured in the United States in 1923, the last year reported by the department of commerce, were valued at $9,083,777 as compared with $8,663,327 in 1821 and $5,017,761 in 1914. The total amount of grain milled in 1923 was 743,234,513 bushels of which 538,312,078 was wheat. In that year 114,438,544 barrels of wheat flour was made valued at $663,302,314, while the total value of cereal products was $1,048,577,544.

Find Where Castings Can Be Sold

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Attaining QUANTITY *With*

GENERAL

PRODUCTION of articles in quantities, an outstanding feature of modern times is the result of industrial evolution and the trend of civilization. Effect of this development on our mode of living, has been pronounced. It has raised our standard of living and has given us more of the enjoyments of the better things of life by bringing within the reach of the masses such things as better clothing, better heating and lighting of homes, improved sanitary equipment, telephones, books, newspapers and even automobiles. Luxuries of a few years back have become commonplace and will be classed as necessities by the next generation. Quantity production is necessarily confined to the manufacture of commodities, enjoying a wide range of distribution and usefulness. Application and use are limited to a certain degree only by their cost to the consumer and may vary from a match to an automobile.

This method of manufacturing has invaded every industrial field and has been equally successful in high and low quality articles. Although we have evidence of this on every hand, a large number of manufacturers as well as consumers still refuse to recognize this truth. They persist in associating quantity production with cheapness, not only in price, but also in quality. This erroneous view only can be attributed to misconception or ignorance of the fundamentals of quantity production.

Since the price and the usefulness of a commodity are the controlling factors in its distribution, the quality as a rule is predetermined and fixed in advance. Therefore production has to adjust itself to quality and not quality to production. This is well illustrated in the textile industry, one of the first to adopt quantity production. Efforts to produce goods in wool, cotton, linen, and silk of a quality and price to satisfy the needs of people in humble circumstances, has not prevented that industry sometimes in the same institution, to produce textiles of the finest quality to satisfy even the most exacting taste. The automobile industry presents cars of a great variety in quality and price. The few manufacturers who do not build on a quantity production basis are prevented from doing so, by prices which restrict their market to a point where the application of quantity production no longer is not practical or possible.

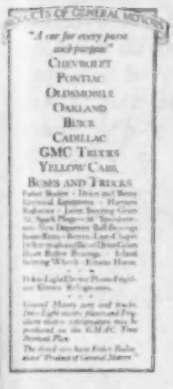
Age of Specialization

Some crities claim that the foundry industry has failed to keep pace with general industrial development. While this criticism is not wholly unfounded, in most cases, it has been offered by people who have little or no knowledge of the peculiarities and difficulties incident to the foundry industry and as a rule has been devoid of practical and helpful suggestions which every progressive foundryman is eagerly seeking.

This age of specialization is leaving its mark on the foundry industry. Specialization already has removed from the jobbing foundry such castings as fittings, pipes, radiators, railroad carwheels, sanitary equipment, bearings, bushings, automobile castings, etc., and many more are to follow. Once a casting has entered the specialty field, price and uniformity of quality place it beyond the reach of the foundry producing a general run of castings.

Limited number of any one piece and the nature of the castings produced by the ordinary jobbing foundry make the application or adoption of even some of the well established foundry

From foundry to finished car



THE *size* of General Motors is of real interest to you.

Your natural question is: "Does this size mean service? Does it make possible a better car for me at a lower cost?"

It does.

For example, the fact that General Motors uses as much as 867,982 tons of steel in one year means that it can purchase the very best grades of steel at the most favorable prices.

And by controlling its own foundries, its parts and accessory companies and the Fisher Body Company, it can secure and pass on to you every advantage of volume production.

From foundry to finished car *quality* is the first law of General Motors.

Whether you select a Chevrolet, a Pontiac, an Oldsmobile, an Oakland, a Buick, a Cadillac or any other General Motors product, you are buying General Motors quality and getting extra value for your money.

MOTORS

devices and equipment impractical. Only the speciality or production foundry can take full advantage of all the modern mechanical, metalurgical and chemical developments and it is to these foundries that the industry owes its rapid development in the past few years. In the manufacturing of castings, as in any other commodity, quantity is the only limiting factor in the application of production methods. Quality and intricacies of design are only influencing factors so far as the selection of equipment and method of manufacturing are concerned.

Flexibility Required

From a standpoint of quality and intricacy of design, the automobile industry requires perhaps the highest grade of castings. That these castings not only can be produced successfully but that also a higher grade of quality is possible under quantity production methods, is a well established fact.

Since the automobile casting foundry in addition to its own peculiarities, also has many of the problems and conforms in general to the production of other castings on a quantity basis, some of its main features will be set forth for consideration.

A foundry producing automobile castings as a specialty differs from the specialty foundry pro-

QUALITY
Improved-I

By Arnold Lenz

NO PRECAUTION Is Neglected to Assure High Quality Even When Production Is Stepped Up to a Maximum. This Is Attested by the Advertisement Shown Reproduced from a Magazine of General Appeal

ducing radiators, car wheels, pipes, etc., in that its general layout and equipment must have greater flexibility. With the exception of one or two well known makes, designs of motor cars contantly have been changing. While perhaps not so apparent to the public, these changes cause a seasonal readjusting and revamping of the methods employed in the production of the necessary castings. In selecting core machines, molding machines, conveyors or cleaning room equipment, this factor must be taken into consideration and a reasonable allowance must be made to take care of the probable changes is size, shape and weight of the various castings.

Force of Specialtists

One of the outsanding features in which a quantity production foundry differs from the regular type of foundry lies in its working force. Instead of the trained and seasoned artisans one would associate with the production of intricate, high quality castings the force is composed entirely of specialtists, trained only in their respective operations reduced to the smallest unit and the simplest form possible. However this does not mean that the force is a conglomeration of nondescript labor. Some of these people become highly skilled and perform their operation with what is to the uninitiated, incredible speed and accuracy. Their performance may be compared with the speed of a trained runner against the speed of an all-around athlete.

A production foundry with 2500 men may not employ over 10 full-fledged molders and coremakers. The burden of supplying the necessary knowledge of the details involved in the manufacturing of a great tonnage of intricate castings therefore falls entirely on the management. Successful operation of a production foundry de-

pends largely on the ability of the management to choose the most effective methods, to standardize the various operations, to select and maintain the most efficient equipment, to design the necessary special appliances and to organize a force in such a way that the product will flow through the plant in a continuous uninterrupted manner. This is best accomplished if the executives are advanced from the ranks by merited promotion.

Although the chief aim of quantity production is toward lower costs, its introduction in some instances has been actuated by a shortage of all-around mechanics. Quantity production never was designed to lower the wages of the workingman, nor was it designed to exclude trained artisans.

Shaking out of molds (hot)	150 to 160
Melting	150 to 160
Cleaning department	125 to 150
Sand blasting	200 to 210

To what extent the workers prosper under this system can be judged in a measure, from the illustration Fig. 1 which shows part of the front yard of one of the production foundries with which the author is identified. About 50 per cent of the automobiles belonging to the workmen are shown in this illustration.

Laboratory Is Necessary

Proper selection and control of raw materials are important factors in the production of quality castings. Repetition of standardized operations presents an opportunity far beyond that possible by ordinary foundry iron loaded into any one car to one tap, which is facilitated by the steady flow of deliveries required in a large foundry.

While a limit in variation is important in cupola practice, it is not so necessary where iron is melted and held in large quantities, as in an open hearth or in an air furnace where it is much easier to maintain an average.

Large consumption and adherence to standard practice, not only in methods but in materials enables the producers of pig iron, coke, sand, corebinder, etc. to furnish these materials to close specifications. Desirability of this business usually brings forth the fullest co-operation in scheduling and guaranteeing deliveries. This is especially true where the producers have the assurance of continued satisfactory business relations although this does not necessarily mean long-time contracts.

Fig. 1.—Automobiles of the employes are parked in part of the front yard of this extensive foundry in which the cupola stacks may be noted near the extreme right and the brick stack of the power house on the left

A prevailing mode of wage payment is piecework based on time studies. A day's work constitutes what a man can do without injury to himself over a long period of time. It is based on the ability of an average man and does not represent the maximum of the exceptional worker. The time required by a new man to reach the specified rate of production may vary from one to two days on some minor operations, to one to three weeks on the more difficult. In the foundry, the rammers usually are recruited from the helpers and the finishers and core setters from the rammers.

The beginner usually is guaranteed a certain day's wage which varies somewhat with the operation, but which in no case falls below the prevailing labor rate. The base rates, which are the amounts the men receive for 100 per cent production, compare with the prevailing common labor rate approximately as follows:

	per cent
Molders	150 to 200
Core makers and core assemblers (male)	150 to 175
Core makers (female)	150 to 200
Iron pourers	150 to 160

methods for checking and noting the effect of the various materials on the quality of the product. A fully equipped laboratory in which the various materials and products are tested and analyzed, forms an indispensible part of the production foundry.

While the chemical composition of coke, iron, sand, limestone, corebinder, etc. are all closely checked in the laboratory, the physical structure and source are recognized as important factors. This is especially true with coke and iron for castings calling for a high brinell number, density and high speed machining qualities. Two brands of coke of practically the same analysis but differing in structure may produce iron with a difference in brinell hardness of 25 to 30 points. The same is ture of the combination of different brands of iron.

Special attention must be given to the variation between pigs in one carload. Aside from an average analysis, the specifications also should call for a limit in variation. These specifications usually can be met at the blast furnace by confining the

Core sands usually are used in the natural state, but a tendency is growing to have all molding sands milled and blended to a specified bond at the pits. This eliminates the uneven and lumpy condition usually found in highly bonded sands.

Among the corebinders, the greatest variation is found in core oils, which still constitute the chief binding material for intricate cores. Linseed oil still is considered the standard but some of the prepared oils are more economical. They lend themselves better to high speed production because the tendency to gum the core-boxes is greatly reduced. Core oil should be bought only from the most reliable sources and great stress should be laid on uniformity, which is much easier obtained by buying in tank car lots than in barrels. A quick and quite satisfactory way of testing incoming oil before unloading is to mix two small batches of silica sand, one

with the new oil and one with a standard oil, such as pure linseed, kept in the laboratory for this purpose. A definite quantity of each is rammed into briquettes, placed on the same plate, dried at the customary temperature, and tested for relative, rather than a given strength. If results are the same and if the color of the oil matches a predetermined sample, it may be put into production quite safely. The iodine value etc., can be checked later.

For best results, an oil that will withstand a fairly high baking temperature should be selected. If the cores are inspected for defects before going into the ovens, even intricate cores requiring much handling in cleaning, grinding and assembling, can be produced with a 3 to 4 per cent loss.

Demand of the consumers for better quality, greater uniformity and closer dimensions in castings is increasing every year. The amount of metal to be removed on finished surfaces in the machine shop is being reduced constantly until it is not uncommon to have an allowance of only 1/32-inch on even a good sized casting.

Only a few years back it was thought impossible to shake out thin walled castings, such as cylinder blocks, before they had almost completely cooled. Any casting taken out of the sand while red hot was sure to develop a heat crack or a warp and special precautions always were taken to avoid any premature shaking out. With continuous pouring and necessity of conserving floor space came also the development of iron that will withstand sudden changes in temperature without ill effects. The shaking out of castings while red hot is becoming the rule rather than the exception. Incidentally, this solution also has produced a superior product by greatly reducing the danger of cracking in the machined and assembled motors.

Various expedients, hollow cores etc., have been resorted to in the past to produce a uniform hardness throughout the full length of the bore. Slow cooling in the region of the water jacket and the valve seats produced a softer iron usually located where the piston rings caused the most wear. If the iron in the charge was made hard enough to counteract this condition, the flanges and thin section usually were so hard that they could not be machined, even at ordinary speed. Today, with only slight changes in the analysis, cylinder blocks can be produced with a uniform hardness in the bore and in

Varied Experience Fitted Author for His Job

WHEN Arnold Lenz was selected to present the 1926 annual exchange paper at the convention of the Institute of British Foundrymen, on behalf of the American Foundrymen's association, a splendid selection was made. He is prepared by training and experience to present to the foundry world the established fact that repetition work, or mass production, as it variously has been called does not necessarily imply any sacrifice of quality. The article accompanying and the remainder which will follow, July 15, are an abstract of Mr. Lenz's exchange paper which was presented in London during the week of June 15.

Mr. Lenz was born May 10, 1888 in Hauingen, Germany where he attended public school. At the age of fourteen he entered the office of the firm Sarasin, Staehelin & Co., Haagen, as an apprentice attending a technical night school during this four year period. In 1906 he emigrated to this country and his first two years were spent working his way through two terms at the New York State normal school, Fredonia, N. Y.

In 1908 he entered the employment of the Browning Foundry Co., Ravenna, O., and later after working as molder, coremaker and melter at the Alliance Brass & Bronze Co. he took his first foremanship with the Ryder Brass Foundry Co., Bucyrus, O. His next position was assistant foundry foreman with the American Clay Machinery Co. of the same city, which was followed by a position with the American Range & Foundry Co., Cleveland, as assistant to the manager.

In May, 1916, he secured a position as instructor in the foundry of the Buick Motor Co., Flint, Mich., where he was promoted to general foundry foreman and assistant superintendent the same year. In January, 1919, he accepted a position as assistant to the manager of the Aluminum Casting Co., Detroit, but

returned to the General Motors Corp. the following May in the capacity of superintendent of the gray iron foundry of the Saginaw Products Co., then under construction. In 1922 he became manager of that plant and in June 1925 he was promoted to assistant to general manager of the Saginaw Products Co., in charge of the gray iron and malleable iron foundries.

which the thin sections can be machined at high speed.

Another vexing problem that confronted foundrymen in the development of quantity production, was how and where to place risers on castings for the purpose of feeding, either by gravity or churning. This problem has been solved to a point where risers for any purpose can be eliminated on automobile castings. The greatest difficulties were presented by flywheels, with a thin web and a heavy rim. Some foundrymen arrange the pouring basin so that it will act as a feeder, but even this is not necessary if a properly designed strainer gate is used.

At one time it was thought impractical to let any one but experienced molders pour the iron, but with the advent of continuous pouring it was soon apparent that the efficiency of the molders could be greatly increased by relieving them of this arduous task. Crews which did nothing but pour iron were formed. At first an attempt was made to teach them to judge the proper pouring temperatures of the various castings and impress upon them the importance of skimming the iron. During the hot summer months, when the labor turn over necessitates the constant use of new men, instructors soon found that all the students could absorb was a knowledge of how to keep the pouring basin, or sprue, filled to the top. This situation was met by placing tin discs over the sprue and the application of strainer gates which skim the iron and regulate the pouring temperature. While they have not been adopted universally they have definitely proved their value and usefulness in the making of automobile castings. Iron will rid itself more readily of slag and produce a more uniform quality if it is melted and poured at a high temperature. If convenient, the iron may be strained through openings placed in the regular cores, but ordinarily it is easier to make separate strainers for this purpose. A number of such cores are shown in Fig. 2.

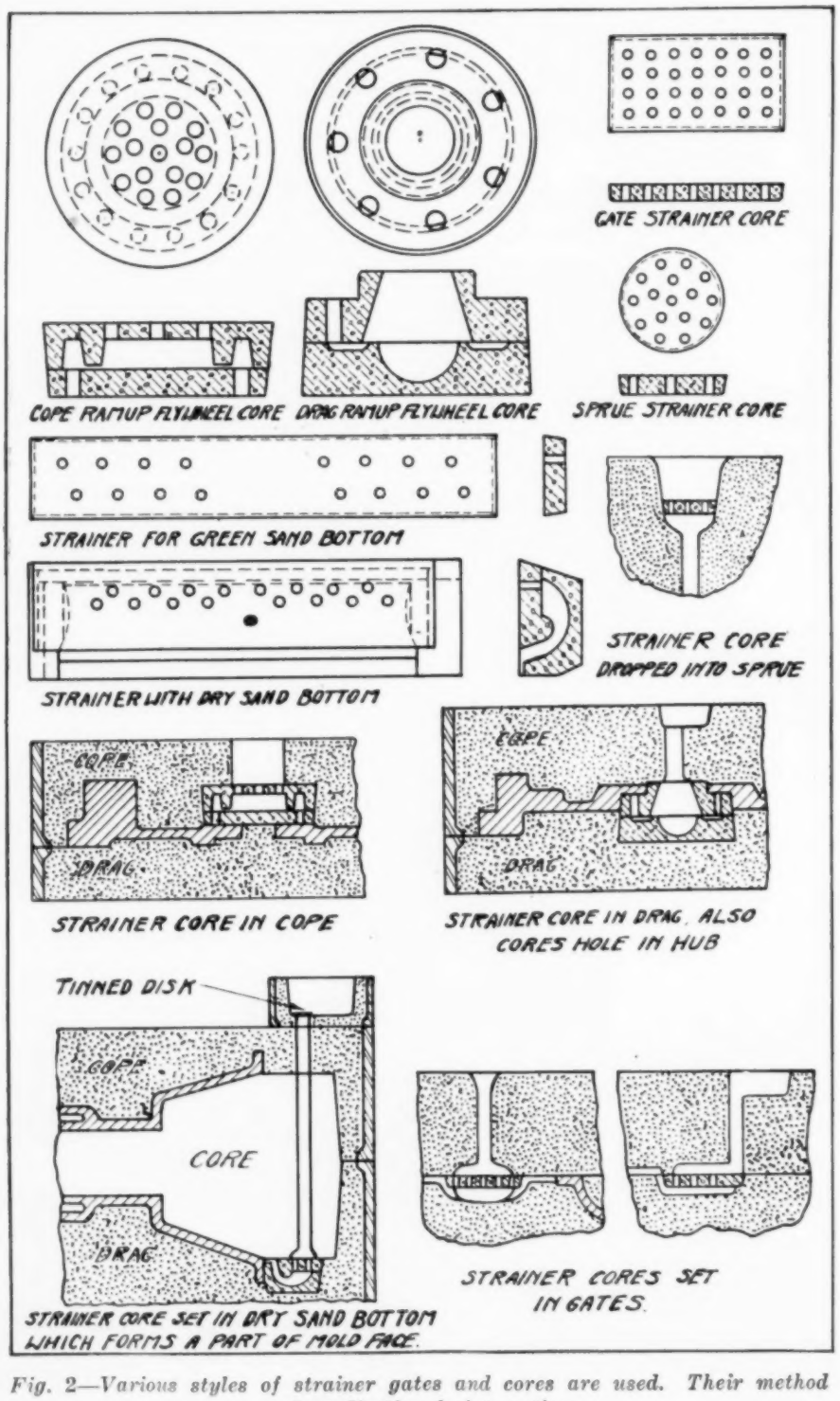

GATE STRAINER CORE
COPE RAMUP FLYWHEEL CORE
DRAG RAMUP FLYWHEEL CORE
SPRUE STRAINER CORE
STRAINER FOR GREEN SAND BOTTOM
STRAINER CORE DROPPED INTO SPRUE
STRAINER WITH DRY SAND BOTTOM
COPE
DRAG
STRAINER CORE IN COPE
STRAINER CORE IN DRAG, ALSO CORES HOLE IN HUB
TINNED DISK
CORE
STRAINER CORE SET IN DRY SAND BOTTOM WHICH FORMS A PART OF MOLD FACE
STRAINER CORES SET IN GATES

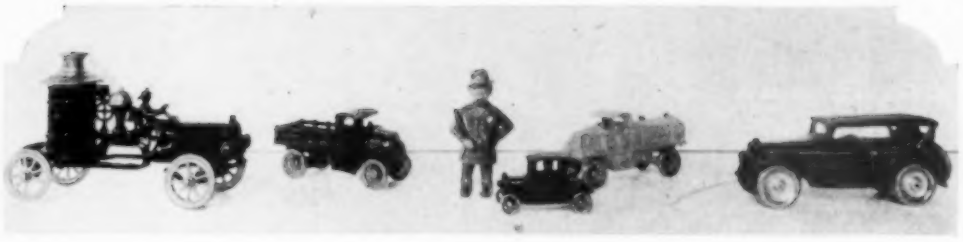
Fig. 2—Various styles of strainer gates and cores are used. Their method of application is interesting

Since the machine shop does not check for dimensions before setting the casting for the first operation, need for close checking exists at the foundry. The most satisfactory way to meet this condition is to guarrantee certain locating points by which the castings are set into the machine. This gives the foundry a chance to build a similar fixture in which, by means of templates, slight variations can be adjusted at the locating points and castings with greater variations can be rejected before they leave the foundry. In malleable, where annealing causes castings to warp they can be run through heavy power presses which make them practically perfect as far as dimensions are concerned. In gray iron, these specifications have to be met without such recourse.

The first requisite in meeting severe specifications is good pattern equipment. A great amount of study and attention to details is required to build pattern and corebox equipment for complicated automobile castings successfully.

To avoid delays and losses, not only in the foundry but in the machine shop every item related to the production of a particular casting should be planned carefully and considered fully beforehand. In a production foundry this reaches far beyond the immediate pattern and corebox equipment, because it is necessary to locate machines and handling equipment definitely and route the flow of the material through the plant in advance.

TOYS



Are Made in Jobbing Shop

By Frank G. Steinebach

DEMAND for various castings used in the manufacture of wagons led to the establishment of the A. C. Williams Co. at Chagrin Falls, O. in 1844. The plant was destroyed by fire in 1889 and was rebuilt the following year, only to be destroyed again by fire two years later. For various reasons, the company did not rebuild at Chagrin Falls, but a new plant was constructed in 1893 at Ravenna, O.

In the early days of the company, the market for wagon castings was brisk and the foundry produced castings for many of the leading wagon manufacturers of the country. However, as the production of wagons increased, the large builders decided it was to their advantage to build foundries of their own, and the shop at Ravenna found its market gradually diminishing. A new line of products was necessary if the company expected to stay in business. At that time the firm started in a small way in the manufacture of cast-iron hardware and later began the production of a line of cast iron toys. Both of these lines have been enlarged greatly until the company builds an exceptionally large number of individual articles coming under the head of toys or cast hardware. Not only are the castings made, but the various parts are assembled, the articles machined where necessary, painted and packed in boxes ready for shipment to the distributor of the merchandise. Practically all of the items manufactured complete at this plant are produced to sell for less than one dollar, while the greater portion of the production may be found in the type of retail chain store specializing in merchandise selling for from 10 to 25 cents.

Radical changes may be noted in the demand for toys since the company first entered the field a number of years ago. The increased amount of money annually apportioned to pleasures, such as the automobile, radio and the theater, indicates the prosperity of the average citizen of the United States today. This prosperity also is reflected in the amount spent for playthings for the younger generation. When father was a boy the purchase of toys was confined largely to that period immediately preceding Christmas, and a few simple toys created sufficient joy to bridge the year. Today the market has spread, and while the heaviest demand for playthings comes at the holiday period, a satisfactory market has developed covering the period from one year's end to the next.

Ordinarily, a market lasting through the entire year is desired by the foundryman, for it enables him to

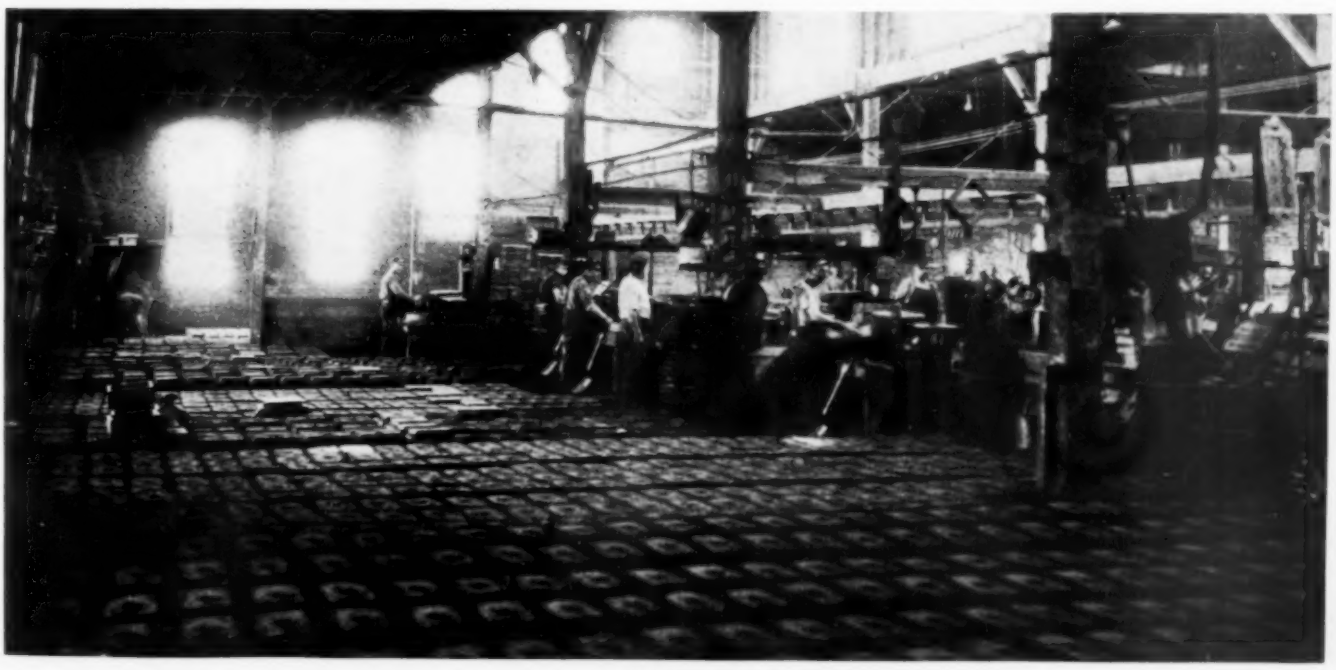


Fig. 2—A Fourth of the Molding Floor Devoted to the Casting of Toys and Hardware. The Molder Starts Work in the Morning at the Wall at the Left of the Illustration and Works Toward the Center Gangway

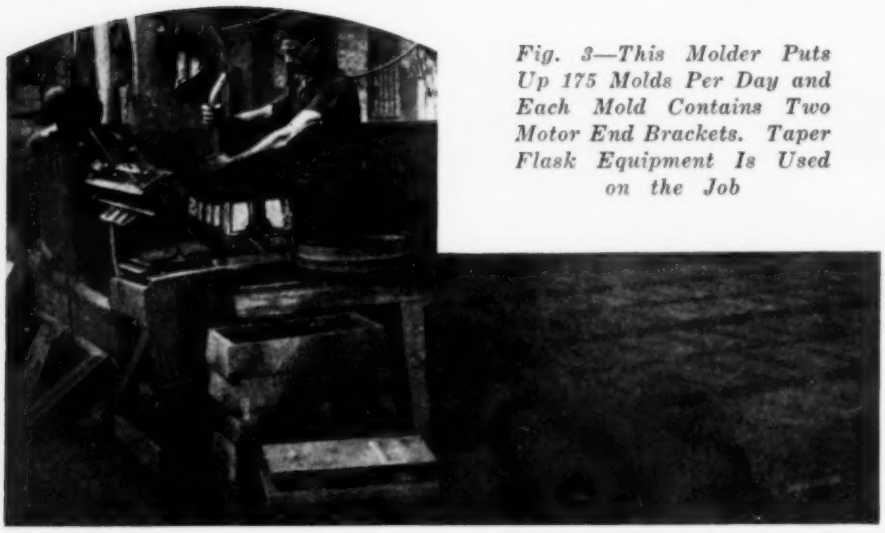


Fig. 3—This Molder Puts Up 175 Molds Per Day and Each Mold Contains Two Motor End Brackets. Taper Flask Equipment Is Used on the Job

avoid periods when the plant must be shut down or operated on a slack schedule. However, the growth in the market for toys has involved a problem in increasing production at the plant of the A. C. Williams Co., due to the seasonal demand of the other products manufactured. Formerly the plant started about the first of the year to produce its line of cast-iron hardware, running on this work until the last of June, when the demand would decline. At that time the production of toys was started and this work was carried on until early in December. With the all year demand for toys, it now is necessary to continue the manufacture of these items during the early months of the year when the market for cast hardware is at its height.

Sold for a Dime

However, this is only one of the many production problems that have been solved by those in charge of this factory. The production of cast-iron toys, which may be sold by the *dime* stores, has necessitated a careful study of manufacturing methods. Perhaps this may be illustrated best by using a toy automobile, shown in the center of Fig. 1, as an example. This article, which is sold by the retailer for 10 cents, is made up of two small castings held together by a long rivet, four cast wheels and two axles. The castings are poured, cleaned by tumbling or with the sandblast, and then are assembled by an operator at a riveting machine. The toy then is painted by the dipping process, each toy wrapped in paper and packed one dozen to the box for shipping. When the other charges, such as freight and profit for the retailer, are considered, it is exceptionally plain that the manufacturing cost must be low. Foundry practice adopted at this plant has been one of the factors maintaining production costs at a sufficiently low level to enable the company to realize a profit.

Much of the work is done on molding machines, although the bench molder plays an important part in the shop. The decision to place the job on a machine rests upon the production required. If a large quantity of castings are to be made, which will be sufficient to keep a machine busy over an extended period of time, the necessary equipment, such as a matchplate or pattern and follow board are constructed, and the necessary flask equipment is provided. Where the quantity of castings to be made is small, where only a small number are required at one time, or where the casting is especially complicated to apply to machine work, the molds are made on benches. Part of the matchplate equipment used is manufactured in the shop.

A certain amount of flexibility results from the ability of some of the older men to do either bench or machine molding. A large number of the molders have been in the employ of the company for periods over 20 years, and one molder has been working on the same floor for 35 years. With these men combining a knowledge of both machine and bench molding, it is possible to allow the day's requirements to govern the selection of the machines or benches, and at the same time to have all of the men at work.

The main molding floor is located in a room 200 feet in length and 60 feet wide, with a gangway extending the full length of the building through the center. The cupola is placed at the center of one side of the building, and the gangway in front of the cupola again divides the molding floor. A quarter of the molding floor taken from almost in front of the cupola is shown in Fig. 2. Another section of the molding floor is shown in Fig. 6.

Use Center Gangway

The bottom boards, flasks, etc., are piled along the center gangway, as may be noted in Fig. 2, and the molder starts working at the wall and travels toward the center gangway. The illustration shows the floor practically full, and a short time after the photograph was taken the blast was turned on the cupola. The molding is

Fig. 4—Each Molder Pours His Own Floor. The Metal Is Carried To the Various Stations in a Ladle Suspended from a Monorail

started at the walls and the materials stored along the center gangway to facilitate cutting the sand. The sand is cut at night with a sand cutter built by the American Foundry Equipment Co., Mishawaka, Ind., and is placed in piles which extend from the wall to the center aisle. The molding machines have wheels on all four legs, and the benches have castors on the front legs, so that they may be moved along the sand heap.

Fig. 5—Heads for Sewing Machines Are Molded on a Jolt-Squeeze Machine. The Drag Half of the Mold Is Shown on the Bench at the Left. A Number of the Cores Also Are Shown

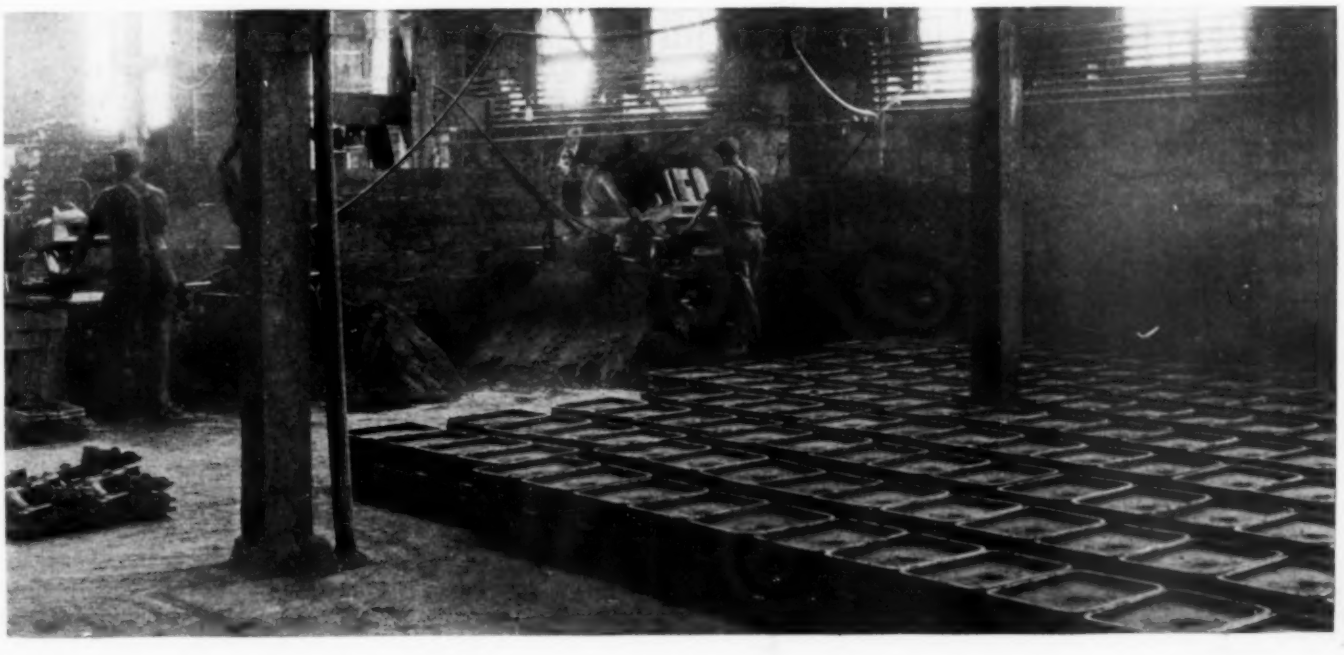
The machine work is handled on 18 machines of the jolt, squeeze type built by the Osborn Mfg. Co., Cleveland, five machines of the jolt-roll-over, squeeze, pattern draw type supplied by the Arcade Mfg. Co., Freeport, Ill., and two jolt-squeeze machines built by the Berkshire Mfg. Co., Cleveland. The methods of adapting these machines to the production work of the shop perhaps may be understood best by describing a few of the particular molding jobs.

At the time the plant was visited, a number of machines were working on molds for parts for various types of toy automobiles and trucks, such as shown in Fig. 1. These items usually are produced in large quantities, and for this reason, the patterns are mounted on plates. The main body of the car or truck is made in two parts, namely a right and a left half. Usually 10 right halves, depending of course on the size of the truck, are made in one mold, while the corresponding left halves are mounted on another set of plates and made in other molds. The molder works on right halves one day, and the left half the next. He keeps a record of the number of right and left half molds made so that an equal number of each will be produced.

Production Is High

The molder first rams up the drag, rolls over the drag and plate, places the sprue pin, fills the cope with sand, and squeezes the mold. The sprue pin then is removed, the pattern drawn and the mold closed. This work is made in snap flasks. Green sand cores make the holes for the axles and for the bolt or rivet holding the two halves together. The gating of the molds depends largely on the size and the shape of the casting. A small truck is gated in both the cope and the drag at a point below the driver's seat and at the rear spring. The mold for the 10 halves of the truck is made in a 14 x 16-inch flask, and the operator makes from 160 to 165 molds per day. On this basis, if he would make the same number of right and left castings daily, he would produce the two large castings for 825 trucks per day. The smallest passenger type car such as shown in Fig. 1, is made with 8 halves to the mold and the operator has made as high as 295 molds per day. The metal used in

Fig. 6—Molding Floor for the Sewing Machine Heads. Sand Is Cut in Two Piles Extending the Length of the Floor, and the Molding Machines Are Pushed Along as the Floor Is Filled



each mold weighs about 3½ pounds.

Wheels, approximately ¾-inch in diameter and used on the trucks and automobiles are made 34 to a 11 x 17 inch flask. The wheels are arranged in four rows and each wheel has three small gates from the main runner. These castings have been gated in the cope, but now are gated either in the drag or cope. The molder makes 175 molds per day, 5950 wheels or approximately 1500 sets of four wheels each. The smallest wheels are made 50 to the mold and the operator produces nearly 300 molds per day. Taper flask equipment built by the Hines Mfg. Co., Cleveland, is used on the latter work.

Changes in the styles of various types of passenger cars manufactured throughout the country are reflected in the demand for toy cars. The child wants a car which approaches as nearly as possible the lines of the real article. For example, the controversy that has accompanied the introduction of the four-wheel-brake principle has made an impression on the younger generation and has created a demand for a toy auto of that type. For this reason, an entire new set of wheel patterns was made for one of the larger types of cars and a metal band was placed on the inside of the wheel to represent a four-wheel-brake. This may seem to be a small item, but when it is considered that in the neighborhood of 20 articles must be scrapped yearly because of the change in styles of the real car, the added cost readily may be noted. A change in style of 20 models probably would necessitate the scrapping of 20 right plates and 20 left plates, and sometimes, as in the case of the four-wheel-brake, the making of a new plate for the wheels.

Toy Line Extensive

Included in the line of toys made are passenger cars in numerous sizes, trucks, double decked busses, fire engines, banks, irons, trains, street cars, stoves, and ranges.

The problems encountered in the manufacture of the line of cast hardware are similar to those found in toy production. Here again the production cost must be held low to make an article which may be sold at the chain stores. For example, a cast hammer consisting of the cast head, the handle and a small wedge holding the handle in place, is sold to the retailer at a price which enables him to dispose of it for 10 cents.

The greater part of this work also is done on machines using follow boards or match plates. On hatchets and hammers, cores are used to make the handle holes and the opening between the claws. The hatchets usually are made four to a mold and arranged so that the blades point outward. The castings are gated from a sprue in the center of the mold. Dampers for stove pipes also are made four to the mold on a machine producing the cope and drag side by side. The mold is squeezed by a hand lever, the two halves of the mold are dropped to a platform below the machine and are carried to the front of the machine through power applied at the hand lever. Handles for screen doors and windows are made in large quantities. The handle patterns are attached to the runner, 12 on each side and are gated at the end of the handle.

Use Three Part Mold

A special guide for a pipe cutter is made in a three part flask. The casting consists of a heavy bottom ring, and three upright parts which support a lighter top ring. The bottom ring and the three supports are made in one pattern and the top ring is made separately. A follow board is used in the molding process, and the three parts connecting the two rings fit into depressions in the follow board. The drag first is rammed and the drag and follow board rolled over. This molds the heavy bottom ring in the drag. The follow board then is removed and after the smaller ring pattern has been set in place, the cheek is set on the drag. The cheek is rammed and a parting made around the bottom part of the smaller ring. The cope is set in place and rammed. Then the cope is removed, the ring pattern drawn, the cheek removed and the pattern drawn from the drag. The drag then is placed on the floor and the mold is closed. Two small cores are used in the heavy ring to lower the machining cost and to prevent a shrink. This work is done on the bench, a molder making 65 molds per day.

Motor end brackets for washing machine motors are made on a jolt-squeeze type machine with taper flask equipment, as shown in Fig. 3. This taper flask equipment was built by the American Foundry Equipment Co. The brackets are made two to the mold and are gated in the drag. The operator places four nails and two cores to each mold and produces 175 molds or 350 end brackets per day. Eleven pounds of metal is required for each mold.

The greatest tonnage of jobbing work turned out at this plant consists of parts for sewing machines. The heads for these machines are molded and poured in a room adjoining one side of the main molding floor. The work is accomplished on two specially built jolt squeeze machines, one of which is shown in Fig. 5, designed for the job by the Osborn Mfg. Co. The sand for this floor is cut in a pile approximately 30 feet long and extending from the outer wall to the gangway. One machine is placed on each side of the sand heap and the two machines are pushed along the floor as the space in the rear of the machines is filled with molds, as shown in Fig. 6. The cope is made on one machine and the drag on the other. The pattern is parted around the center of the head, as may be noted in Fig. 5, and one-half is molded in a horizontal position in the cope and one-half in the drag. The two machines may be operated by one man if one of the molders is absent or when a limited production is required. In this case the operator makes a number of drags on one machine, places them on the floor and sets the cores and then makes the drags on the other machine. A view of the molding floor where the sewing machine head castings are made is shown in Fig. 6. Two molders produce 260 molds per day on the two machines. The casting requires 12 pounds of metal and weighs 8 pounds when cleaned.

The type of work produced in this plant does not require the extensive use of cores. The cores for the sewing machine head, shown in Fig. 5, and cores for some electric lighting fixture work which is produced at the shop on a jobbing basis, are blown on a machine manufactured by Wm. Demmler & Bros., Kewanee, Ill. The cores for hatchet and hammer handle holes are made on extrusion type machines built by the Wadsworth Core Machine & Equipment Co., Akron, O. The latter cores are made and baked in long sticks and then are cut to the desired lengths by an emery wheel.

Uniform Analysis

The metal is melted in a 72-inch cupola lined to 60-inches, which was manufactured by the Whiting Corp., Harvey, Ill. A monorail system serves the main gangway from one end of the foundry to the other, and a track also runs to the molding floor for sewing machine castings and from there back to the cupola. The metal is carried from the cupola to the molders in five 500-pound ladles. Each molder pours his floor with a hand ladle.

Constant uniformity is maintained in the analysis of the charge and only one mixture is used. The charge consists of pig iron with 3.25 per cent silicon, 0.05 per cent sulphur, 0.40 to

0.60 per cent phosphorus and from 0.60 to 0.80 per cent manganese, and returned shop scrap. No foreign scrap is used. The analysis of the metal is as follows: Sulphur 0.06 to 0.07 per cent; silicon 3.0 per cent; phosphorus 0.60 per cent; and manganese 0.60 per cent. This mixture produces a casting which meets the requirements of the jobbing customers, since the casting may be machined readily, and it also has proven satisfactory for the toy and hardware work. If a casting cannot be poured with this mixture, the company will not take the job, for it will not undertake to change the mixture. Under normal conditions, from 16 to 18 tons of iron are melted per day.

After the molder pours his floor, he dumps the castings and sand and stacks the bottom boards near the machine. A night crew, consisting of five men, comes on about 4 o'clock in the afternoon. This crew takes the castings from the sand and places them in the gangway. The sand then is cut. The cutter makes a trip around the main molding floor, going down along one wall and back along the opposite wall, and then finishes up in the smaller room where the sewing machine head castings are made. Three men, who start to work at 3 o'clock in the morning, knock off the gates and sprues from the castings and haul the castings to the cleaning room. The castings then are packed in tumbling barrels so that the cleaning operation may start as soon as the day crew begins work in the morning. Eleven tumbling barrels and six water mills, which were built by the W. W. Sly Mfg. Co., Cleveland, are in use. A sandblast mill also is used on some classes of work. After the castings are cleaned, they are taken to the grinding room where any necessary grinding is accomplished. The castings then are taken to the finishing department, where they are assembled, or if the raw castings are to be sold, to the shipping department.

Advantage has been taken of topography of the land and of the fact that the railroads have tracks at two levels nearby, in laying out the plant. The buildings are built on the side of a hill. The storage for pig iron, coke, etc., is located at the top of the hill and is served by a track from the high level of the Pennsylvania railroad. Materials are unloaded from the car and stored on the level of the charging door of the cupola. The materials then go through the foundry and the finishing department to the shipping room at the opposite end of the plant. This department is served by a house track which connects with the lower level of the Pennsylvania railroad, the Baltimore & Ohio railroad and the Erie railroad.

Ordinarily, from 45 to 55 molders and 9 night men constitute the crew. J. H. Bigelow is president, C. A. Heisler, vice president and treasurer, and Thomas Fletcher, secretary of the A. C. Williams Co.

Readers Comment

Note—Material appearing under this head does not necessarily reflect the opinion of The Foundry or of its editors.

Blames Forman for Low Foundry Production

To the Editors:

The writers, two practical molders who have worked for years on the floor, have come to the conclusion that much of the inefficiency and low production in many foundries today may be attributed to a lack of fundamental knowledge on the part of the foundry foreman.

Why are many foundries considered a poor investment and are given a low rating? Why are so many foundries going out of business or becoming bankrupt? One reason for these conditions is the low production realized by many plants, which in turn may be traced to the ignorance of the foundry foreman regarding modern foundry practice.

It seems that some foundry owners believe it more profitable to retain a foreman, who does not know his business, rather than secure a first class mechanic. We often think that the only qualification necessary to secure a position as foundry foreman is to possess a large amount of that attribute commonly called *gift of gab*. Some foremen think that their major duty consists of securing a pattern from the pattern shop or storage, and throwing it at the molder with simply the order to "make one." If the casting is made successfully, many foremen then are prone to take the credit, while if the casting has any one of the many defects which may relegate it to the scrap pile, the foreman seems too willing to place the blame on the molder.

At one time we worked in a shop located in New York state which was the only foundry in the town and had a monopoly on the work in that section. The work at this shop was the most difficult of any place we ever worked, due, we feel to the lack of experience and good judgment on the part of the foundry foreman. Despite the hard work and effort on the part of the molders, production was far below what it should have been.

Later we became connected with a company located about 800 miles away which secured this work at a lower price than that formerly secured by the local foundry. The foreman at the new plant was fitted for the job and used modern methods. In some cases we were able to do twice the work in one day, and we made $2.00 a day more.

This foreman had a knowledge of the smallest details of his work, and was able to make the necessary rigging to fit the work. This factor enabled the molders to increase their production, and also bettered working conditions. While this shop was starting an expansion program, the foundryman formerly making the work was trying to persuade his banker to make another loan. However, he continued to employ the inefficient foreman.

It might be well for foundrymen to put prospective foremen to work on the floor for a month to see if they understood the fundamentals of molding, before giving them the job.

Edward Kirris
Richard Strom

Book Review

Metallography and Heat Treatment of Iron and Steel, by Albert Sauveur, 557 pages, cloth, 7 x 10½ inches, published by the University Press, Cambridge, Mass., and supplied by THE FOUNDRY, Cleveland, for $8.00; 2-3 Caxton House, Westminster, S. W. 1, London, for 34s.

Metallurgists and metallographers need no introduction to this important work on iron and steel. The reception of the first two editions has been such that the author has been prevailed upon to revise and incorporate the advance recorded in metallography since the previous edition published in 1916.

To incorporate this advance many of the chapters have been rewritten and over a hundred new illustrations are added. This third edition by Dr. Sauveur is a valuable addition to the technical, plant or individual library.

Oxygen Affects Charcoal Iron

Tests by Bureau of Standards Fail To Confirm Theory That Strength Increases with Oxygen Content

By James R. Eckman, Louis Jordan and W. E. Jominy

A PAPER by W. E. Jominy was presented at a meeting of the American Foundrymen's association in Milwaukee, comparing the mechanical properties of charcoal and coke pig irons and of the remelted cast irons from these two types of pig iron.*[1] Data given in that paper showed that the average brinell hardness, tensile strength, transverse strength, and deflection for cast-iron test bars prepared by melting charcoal pig iron were appreciably higher than for those of approximately the same chemical composition but prepared by melting coke pig irons. Results obtained with a second series of test bars cast from the remelted original bars showed that these differences in the mechanical properties, in favor of the charcoal irons, persisted after the remelting of the original castings.

Mr. Jominy also called attention to a difference in the size and form of the graphite in the strong and weak castings. The graphite of the coke irons in general was in the form of rather thick and long flakes or plates, while the graphite of the charcoal irons tended toward smaller and more rounded particles. It was regarded as logical that the thicker and longer graphite flakes in the coke irons should be held responsible for the weakness of those irons inasmuch as the longer flakes broke up the continuity of the metallic matrix to a greater degree than did the smaller and more rounded graphite particles of the charcoal irons.

J. E. Johnson, Jr., concluded from his investigations on the influence of oxygen on the strength of cast iron*[4] that under identical melting and casting conditions irons containing considerable amounts of oxygen were stronger than irons of practically the same chemical composition except for a lower oxygen content; that pig irons made at lower temperatures contained more oxygen and, therefore, charcoal pig irons, made normally at lower blast temperatures than coke pig irons, contained more oxygen and yielded stronger castings. He stated further that oxygen had this effect on the strength of cast iron through its influence on the form in which the graphite separated. The higher oxygen content of the charcoal irons was stated to be the cause of the more nodular form of graphite in those irons.

Mr. Jominy's comparison of coke and charcoal irons confirmed Mr. Johnson's statements of the tendency toward higher strength in charcoal irons, quite probably caused by the smaller, more nodular graphite. Mr. Jominy's work also tended to support Mr. Johnson's claims that the cause of these differences between strong and weak (charcoal and coke) irons should be sought in some as yet unrecognized difference in chemical composition since the differences in structure and strength persisted on remelting and casting under parallel conditions.

Analyses for oxygen made by Mr. Johnson by the Ledebur method indicated higher oxygen content in the stronger pig iron of each of the three pairs of strong and weak irons listed in his report. Inasmuch as this was the only difference found in the chemical composition Mr. Johnson argued that it was the cause of the difference in physical properties and that this difference in oxygen content persisted in the remelted cast irons since the same differences in physical properties remained.

The Ledebur method for oxygen used by Mr. Johnson is of limited application and could not have given accurate results on a high carbon material such as pig iron, when only the oxygen of the water in the gases leaving the furnace was determined.*[5] The error on this account would result in values for oxygen lower than the true values since a portion of the oxides in the sample would be reduced by the carbon in the metal.

The higher values for oxygen reported by Mr. Johnson, however, are quite considerably in excess of the amounts of oxygen usually found in pig irons or cast irons by the method, lately developed at the bureau of standards, for determining oxygen by fusion in vacuum.*[6]

Following Mr. Johnson's first suggestion that the presence of oxygen in cast iron was an advantage, the literature records varying opinions on the point and some data in support of Mr. Johnson's claims.*[7]

In determinations of oxygen in cast iron made quite recently, Mr. Oberhoffer and his associates have obtained results which support Mr. Johnson's claims of the strengthening influence of oxygen.*[8] In gray cast irons containing approximately 3.5 per cent total carbon and 1.7 to 1.8 per cent silicon, they found oxygen to vary from 0.046 to 0.198 per cent by weight. By plotting oxygen against mechanical properties their average results for three series of irons indicate that with increasing oxygen the Brinell hardness, modulus of rupture, tensile strength, and shrinkage all increase while the impact resistance and density decrease. Mr. Oberhoffer also points out the occurrence of smaller graphite flakes in the irons containing the larger amounts of oxygen.

Mr. Oberhoffer's values for oxygen in the cast irons he examined were obtained by a modified Ledebur method which should give more correct results than the methods used by Mr. Johnson. Mr. Oberhoffer's values for oxygen are nevertheless higher than Mr. Johnson's and, consequently, far

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[1]From a paper presented before the convention of the American Foundrymen's association held in Syracuse, N. Y. Two of the joint authors James R. Eckman and Louis Jordan are connected with the bureau of standards, Washington. W. E. Jominy is on the satff of the University of Michigan, Ann Arbor, Mich.

[2]Published by permission of the director of the bureau of standards of the U. S. Department of Commerce.

[3]W. E. Jominy, Characteristics that Chemical Analysis Fails to Disclose in Pig Irons and Castings, Trans. American Foundrymen's Assoc., 32, Part 1, pp. 476-95; 1924.

[4]J. E. Johnson, Jr., The Influence on the Quality of Cast Iron Exerted by Oxygen, Nitrogen, and Some Other Elements, Trans. Am. Inst. Min. Eng. 50, p. 314; 1914. Also U. S. Patents 1,106,817; 1,150,201; and 1,231,259.

[5]J. R. Cain and L. Adler, Equilibrium Conditions in the System, Carbon, Iron Oxide, and Hydrogen in Relation to the Ledebur Method for Determining Oxygen in Steel. sci., papers, bureau of standards, No. 350; 1919.

[6]Louis Jordan and James R. Eckman, Gases in Metals II. The Determination of Oxygen and Hydrogen in metals by Fusion in Vacuum. Bureau of standards sci. paper on Press.

[7]J. A. Pickhard, The Oxygen Content of Iron and Steel, Iron and Steel Inst., Carnegie Scholar. Mem., 7, pp. 68-82, 1916; W. L. Stork, Oxygen in Cast Iron and Its Application, Iron Age, 103, pp. 1636-7, 1919, J. Shaw, Problems of the Foundry, Foundry, 49, pp.759-61. 1921.

[8]P. Oberhoffer, E. Piwowarsky, A. P. Schiessl and H. Stein. Ueber Gas-und Sauerstoffbestimmungen in Eisen insbesondered Gusseisen. Stahl und Eisen, 43, pp. 113-116; 1924.

Table I

Johnson's Values for Oxygen in Strong and Weak Pig Irons

Type of Iron	Trans. Strength Pounds	Total Carbon Per Cent	Graph. C Per Cent	Comb. C Per Cent	Si Per Cent	MN Per Cent	P Per Cent	S Per Cent	O Per Cent
Strong.....	3,200	4.00	3.22	0.78	1.90	0.62	0.139	0.017	0.027
Weak.....	2,700	4.09	3.43	.66	1.88	.70	.112	.020	.009
Strong.....	3,450	4.00	3.05	.95	1.00	.46			.038
Weak.....	2,650	4.05	3.15	.90	1.00	.50			.009
Strong.....	3,850	4.10	3.50	.60	.70	.60	.128	.035	.065
Weak.....	2,500	4.49	3.60	.89	.72	.59	.108	.024	.007

above the values obtained on any cast irons by the bureau of standards' vacuum fusion method.

Ledebur Method

The original Ledebur method, as used in Mr. Johnson's work, determined the water formed by passing hydrogen over a sample of pig iron chips heated to 900 to 1000 degrees Cent. Mr. Cain and Mr. Adler have shown that such a procedure, in the case of ferrous materials containing combined carbon, would fail to recover all of the oxygen in the sample since a considerable proportion of the oxide would be reduced by carbon and would be present as CO or CO_2 in the gases leaving the furnace. More recently Mr. Oberhoffer has called attention to the same difficulty. Mr. Johnson's results for oxygen in his pig irons, therefore, must be in error on this account.

Mr. Oberhoffer made provision for determining both CO and CO_2 in the gases leaving the furnace in the modified Ledebur method used in the research in which he confirmed Mr. Johnson's earlier work.

The vacuum fusion method developed and in use at the bureau of standards for the determination of oxygen in iron and steel is more satisfactory than either of the preceding methods as applied to pig irons or cast iron. The reduction of the oxides in the iron is accomplished by means of carbon. The sample of iron, as a single piece of metal weighing about 30 grams, is carefully cleaned by grinding the surface and washing in alcohol and ether. It is then fused by high frequency induction heating in a gas-free graphite crucible placed within a closed-end silica tube and the H_2O, CO_2, CO and H_2 evolved from the sample are determined gravimetrically. The sample is held molten for an hour or longer at 1450 to 1500 degrees Cent. under reduced pressure to allow the complete reduction of all oxides. It has been shown that under these conditions the oxides of iron, manganese, aluminum, silicon, titanium and zirconium, which may be present in an iron or steel, are completely reduced.

Both the original Ledebur method used by Mr. Johnson and Mr. Oberhoffer's modified method require the use of a finely divided sample of the pig iron or cast iron. Neither Mr. Johnson nor Mr. Oberhoffer state in detail how their samples were prepared or what precautions were taken to prevent surface oxidation of the fine iron chips. That surface oxidation may cause serious errors has been shown by many analyses made by the vacuum fusion method on chips and single-piece solid samples from the same material. For example, a steel which contained 0.02 per cent oxygen according to the vacuum fusion method using a solid sample, gave a value for oxygen of 0.04 per cent when the analysis was made on milled chips even though the chips had been cut under oil and then carefully cleaned and dried. A second example, even more to the point in the present discussion of cast iron, was the case of two white irons made for malleabilizing. Samples of these hard irons were prepared by crushing under an air hammer in a tool-steel mortar. The crushed iron sample was separated into two portions, one of material passing a 20-mesh but not a 40-mesh screen, and the other of material passing a 40-mesh but not a 120-mesh screen. These two samples of each iron were run separately for oxygen by the vacuum fusion method as well as a solid sample of each iron. The results show that the values for oxygen obtained on the crushed samples gave no indication of the actual oxygen content of the iron.

The results in Table 2 for the coarse

Table III

Gases in Charcoal Cast Irons

Sample Number	Tensile Strength Pounds per Square Inch	Gases, Per Cent by Weight: Oxygen Det'ns.	Oxygen Average	Hydrogen Det'ns	Hydrogen Average	Nitrogen Det'ns.	Nitrogen Average
X76	31,500	0.005		0.0004		....	
		Nil		.0002		....	
		Nil	0.002	.0002	0.0003	....	
X75	30,400	Nil		Nil		0.001	
X60	29,800	Nil	Nil	Nil	Nil	.001	0.001
		Nil		Nil		.001	
X11	28,850	Nil	Nil	.0001	<.0001	.001	.001
		Nil		Nil		.001	
X79	27,400	Nil	Nil	Nil	Nil	.001	.001
		Nil		Nil		.001	
X74	27,000	Nil	Nil	Nil	Nil	.001	.001
		Nil		Nil		.001	
X 0	25,850	.001	<.001	Nil	Nil	.001	.001
		.004		.0006			
		.001		Nil		.001	
X69	25,200	.006	.004	.0005	.0004	.001	.001
		.008		.0005		.002	
X66	24,800	.006	.007	.0006	.0006	.002	.002
		.010		.0008		.002	
		.010	.010	.0009	.0009	.003	.003
XX60	....	.002		.0001		.001	
		.005	.004	.0005	.0003	.001	.001
XX74	....	Nil		Nil		....	
		Nil	Nil	.0001	<.0001	....	....
XX75	....	Nil		.0014			
		Nil		Nil		.001	
		Nil	Nil	.0001	.0005	.001	.001
Average			0.002		.0003		.001

Table II

Oxygen in White Cast Irons
Errors Due to Surface Oxidation of Chips

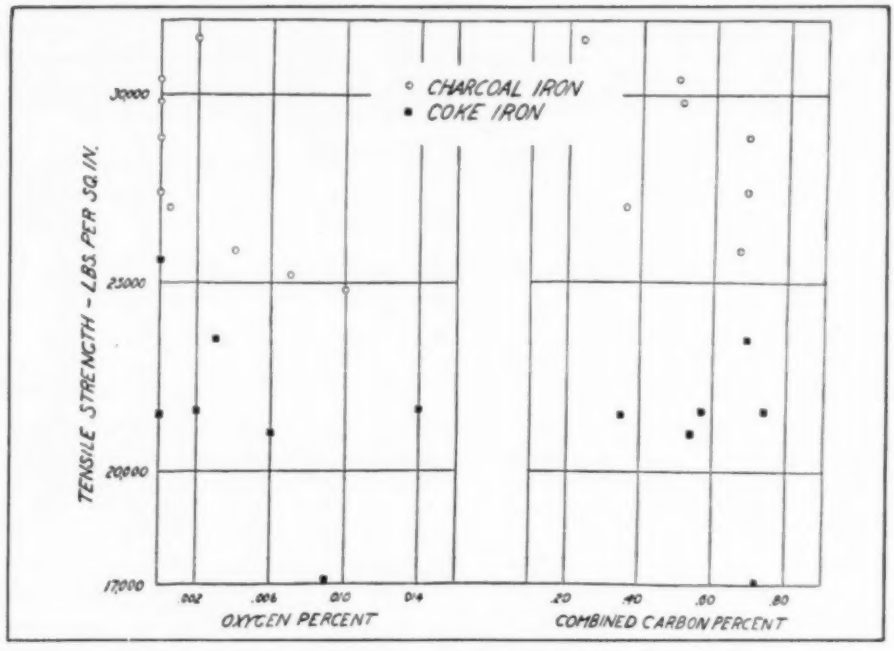
Type of Sample	Oxygen, Per Cent by Weight: Iron I	Iron C-I
Solid piece	0.009	0.009
Coarse crushed (20-40 mesh)	.045	.051
Fine crushed (40-120 mesh)	.108	.124

and fine crushed samples are of the same order of magnitude as the values for oxygen reported by Mr. Johnson 0.01 to 0.07 per cent and Mr. Oberhoffer 0.05 to 0.2 per cent. The vacuum fusion method, using solid samples with carefully ground and cleaned surfaces, thus far has given an oxygen content always lower than 0.02 per cent for cast irons of normal production.

Oxygen Cast Irons

As the vacuum fusion method for oxygen appears to be more satisfactory than any of the previously used methods for determining oxygen in cast iron, analyses were made of some of the charcoal and coke cast irons investigated by Mr. Jominy. The results of these analyses have failed to support the conclusion of Mr. Johnson and of Mr. Oberhoffer as to the strengthening effect of oxygen on the mechanical properties of gray cast iron.

All analyses were made in duplicate and on samples of one or two solid pieces of cast iron with carefully ground and cleaned surfaces. The numbering of the samples is the same as in the original paper by Mr. Jominy. An *X* preceding the sample number designates the first remelt of a pig iron, while *XX* denotes a remelt of the single *X* cast iron. In the tabulation of results, less than 0.001 per cent oxygen is reported as *Nil*. The charcoal and coke irons are listed in Tables 3 and 4 in the order of decreasing tensile strengths. It is evident that the stronger charcoal irons are not distinguished from the weaker coke irons by any higher content of oxygen. This is seen more readily in the left-hand portion of Fig. 1 where the oxygen contents of both types of iron are plotted against the tensile strength. Quite contrary to Mr. Johnson's and Mr. Oberhoffer's results, if one considers the charcoal and coke iron series separately, those irons of either type which show the higher strengths of their group are generally low in oxygen. None of the irons listed in Tables 3 and 4 have



RELATION OF TOTAL OXYGEN AND COMBINED CARBON TO TENSILE STRENGTH OF COKE AND CHARCOAL CAST IRONS

Table IV

Gases in Coke Cast Irons

Sample Number	Tensile Strength Pounds per Square Inch	Gases, Per Cent by Weight: Oxygen Det'ns	Oxygen Average	Hydrogen Det'ns.	Hydrogen Average	Nitrogen Det'ns.	Nitrogen Average
X 7	25,600	Nil		Nil		0.001	
		Nil	Nil	Nil	Nil	.001	.001
X 6	23,500	0.003		0.0004		.002	
		.003	0.003	.0005	0.0005	.002	.002
X37	21,600	.014		Nil		.001	
		.014	.014	Nil	Nil	.001	.001
X 4	21,600	.002		.0002		.001	
		.002	.002	.0001	.0002	.001	.001
X 3	21,500	Nil		.0003		.001	
		Nil	Nil	.0003	.0003	.001	.001
X23	21,000	.005		.0001		.001	
		.006	.006	Nil	<.0001	.001	.001
X36	17,100	.008		.0002		.001	
		.009	.009	.0004	.0003	.001	.001
XX37	....	.003		Nil		.001	
		.003	.003	Nil	Nil	.001	.001
Average			.005		.0002		.001

Table V

Combined and Graphitic Carbon in Cast Irons of Similar Silicon Content

Sample Number	Tensile Strength Pounds Per Square Inch	Charcoal Irons: Graphitic C	Combined C	Si	S
		Per cent	Per cent	Per cent	Per cent
X11	28,850	3.42	0.69	1.27	....
X 0	25,850	3.29	.67	1.70	0.012
X60	29,800	3.39	.51	1.90	.009
X79	27,400	3.31	.69	2.04	.011
XX75	....	3.22	.60	2.11	....
X75	30,400	3.36	.50	2.15	.009
X74	27,000	3.43	.36	2.47	.009
X76	31,500	3.54	.24	2.84	.009

Sample Number	Tensile Strength Pounds Per Square Inch	Coke Irons: Graphitic C	Combined C	Si	S
		Per cent	Per cent	Per cent	Per cent
X 6	23,500	3.22	0.69	1.70	0.015
X37	21,600	3.09	.74	1.99	.033
XX37	.....	3.18	.62	2.03	....
X 7	25,600	....	....	2.06	.016
X36	17,100	3.00	.72	2.10	....
X 4	21,600	3.28	.57	2.11	.027
X23	21,000	3.10	.54	2.44	.026
X 3	21,500	3.21	.35	2.88	.020

an oxygen content nearly as high as the minimum value, 0.04 per cent reported by Mr. Oberhoffer for his cast irons and the highest oxygen content of any iron in the present investigation, 0.014 per cent, is nearly the same as the minimum value, 0.009 per cent, reported by Mr. Johnson and the content of his weak irons.

Hydrogen and Nitrogen

Hydrogen and nitrogen contents of the coke and charcoal irons are listed in Tables 3 and 4. Values for the hydrogen content of all samples were obtained in the course of the determination of oxygen by the vacuum fusion method. Less than 0.0001 per cent hydrogen is reported as *Nil*. Values for nitrogen were obtained by the Allen method for combined nitrogen.* Neither hydrogen nor nitrogen contents show any differences characteristic of the stronger or weaker irons.

When it became evident that the content of oxygen, nitrogen, or hydrogen did not serve to distinguish the strong and weak irons, two supplementary tests were made without attempting any systematic examination along lines other than gas content. Combined carbon was determined in a number of representative irons and spectrographic analyses were made on two coke and two charcoal irons. The first test was made to indicate whether the higher strength of charcoal irons should be attributed to a matrix which was stronger on account of the smaller, more rounded form of graphite, or on account of higher combined carbon. The spectrographic examination was made on the chance of detecting some less common metallic element present in one class of irons but not in the other and which had escaped determination in the usual analyses.

Determinations of combined carbon were made on as many samples as were available of those charcoal and coke irons that were selected by Mr. Jominy in his paper for comparison in pairs on the basis of similarity of chemical composition as judged by the silicon content. The results of these analyses are given in Table 5. It is evident that the combined carbon also fails to furnish any difference in chemical composition characteristic of the strong or weak irons. This is shown also in the right-hand portion of the accompanying illustration where combined carbon is plotted against tensile strength.

The arc spectra of two charcoal and two coke irons X 60 vs. X 37 and X 74 vs. X 23 of similar composition were compared in the attempt to detect the presence in either the coke or charcoal irons of any unusual metal characteristics of either type of iron. Titanium, vanadium, chromium, nickel, and copper were shown on the spectrograms. From visual estimates of the intensities of the spectral lines no differences in any of these elements were indicated as characteristic of either class of iron.

The general tendency of charcoal cast iron to exhibit greater strength and contain a finer and more nodular form of graphitic carbon than coke cast iron of similar composition, melted and cast under identical conditions, has been attributed on the basis of Johnson's investigations to higher oxygen in the stronger irons. Mr. Oberhoffer supports Mr. Johnson in the contention that oxygen strengthens gray cast iron. Careful analyses of 12 charcoal and eight coke irons, whose mechanical properties had previously been reported by Mr. Jominy, failed to show that the stronger irons contained more oxygen than the weaker irons. The rather small differences observed in the results of the oxygen analyses pointed more toward a slightly higher oxygen content in the weaker irons. The values for oxygen in both the stronger and weaker cast irons were much lower than the general range of values reported by Mr. Johnson and by Mr. Oberhoffer. The vacuum fusion method of analysis used in the present investigation for determining oxygen is more accurate, as applied to cast irons, than the methods employed in previous investigations. Determinations of hydrogen, combined nitrogen, graphitic and combined carbon, and spectrographic analyses for minor metallic constituents likewise failed to reveal any differences in chemical composition which were characteristic of the charcoal and coke cast irons.

Book Review

Transactions of the American Foundrymen's Association, Vol. XXXIII, edited by Robert E. Kennedy, cloth, 9 x 6 inches, 987 pages, published by the American Foundrymen's association, Chicago, and a limited number of copies available through THE FOUNDRY, Cleveland, for $7.00, 2-3 Caxton House, Westminster, S. W. 1, London, for 35s.

Foundrymen and others interested in the foundry industry will welcome this latest annual publication by the American Foundrymen's association, which is provided to all members of that organization. The first section of the book, constituting 64 pages is devoted to the proceedings of the 29th annual meeting, and various reports. The remainder of the book contains in full the 45 papers that were read at the technical sessions held in Syracuse, N. Y., Oct. 5-9, 1925. Discussions of the papers also are included. The papers cover practically every phase of the foundry industry, and include a number on brass and bronze, on aluminum and aluminum alloys, on cast iron founding and metallurgy, on general foundry practice, on steel founding and metallurgy, on foundry safety, on sand testing and control and on malleable founding and metallurgy.

Composition of Foundry Parting Material

Question: What kind of manufactured parting materials are used in foundries and how are they prepared?

Answer: Manufacturers of foundry equipment and supplies have placed on the market under various trade names, various kinds of almost impalpable powder designed to serve as parting mediums. Naturally the composition of the powder is guarded as a trade secret, but it is generally understood that lycopodium and tripoli form the base.

Lycopodium is a species of club moss found in many parts of the world. A yellow powder found in the sporecases of all the species is highly inflammable. It is employed in the manufacture of fire works and for the production of lightning and other scenic effects on the stage. The powder affords a strong resistance to moisture and for that reason it is used as a covering for pills. It is known in England as lycopode or vegetable brimstone and in Germany as *Blitzmehl* or *Hexenmehl* (lightning meal or witch's meal)

Tripoli is a name applied to a silicious ooze composed chiefly of silicious shells or diatomaceous earth. It resembles clay or chalk, but is a little harsh between the fingers and will scratch glass. The material is used principally in the buffing and polishing industry, but a certain amount is absorbed by the foundry where as previously stated it is used as a parting medium. It is shaken in the form of dust from a cotton bag to cover the joint surface of the mold so that the adjoining part of the mold will not stick. Also it is used quite freely to cover the surface of patterns, especially metal patterns, before they are covered with sand. This treatment prevents the sand from adhering to the pattern and insures a clean *draw* and a perfect surface on the mold.

*The determinations of nitrogen were made by R. J. Kranauer of the bureau of standards using the Allen method as described in bureau of standards scientific Paper No. 457.

LARGE Ingot Mold Plant Opens in Central West

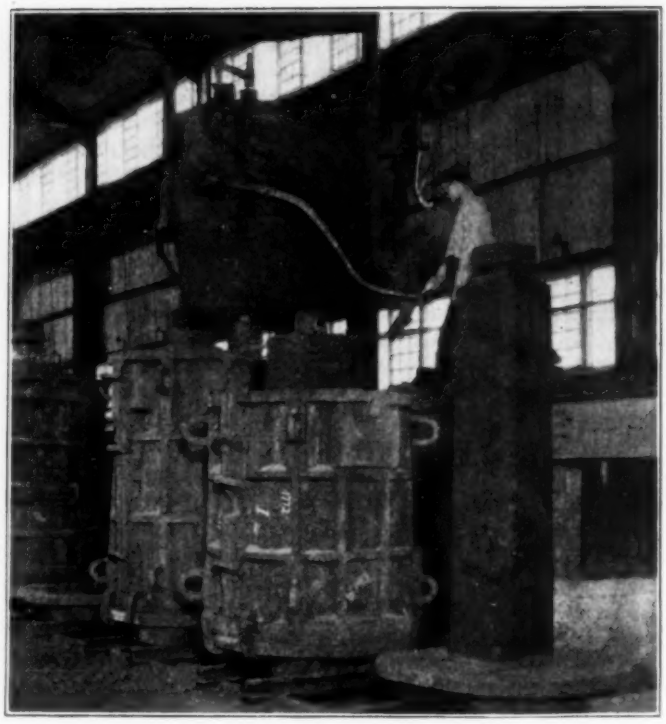


Fig. 2—Direct Metal from the Blast Furnace Is poured Into Open Top Molds from a Bottom Pour Ladle

FOLLOWING the completion of the South Chicago plant of the Valley Mould & Iron Corp., Sharpsville, Pa., ingot molds now are made for the first time on a commercial basis in the Chicago district. It is the first plant of the kind west of Pittsburgh and may be regarded as an indication of the growth of the steel industry in the central west.

Erected close to the two Federal stacks of the By-Products Coke Corp., at East 108th street and the Calumet river, the plant is in a position to secure hot metal readily and to share in the advantages of a joint power station. Less than 1000 feet separate the casting platform in the foundry from the cast house at the blast furnace. At present the plant is designed, equipped and operated on an output of 15,000 tons of ingot molds a month. Ultimately the capacity of the plant will be 25,000 tons a month.

The main building of mill type construction and with sheet steel sides and roof, parallels the Calumet river for 816 feet. The structure is 60 feet wide and is flanked by three side bays, one 30 x 288 feet for sand handling; one 70 x 140 feet for a green sand foundry where stools and equipment are made; and, a third 70 x 196 feet devoted to the storage of equipment, a machine shop and a chamber for the air compressors.

The long main building favors the location of equipment for straight line operation starting at the end nearest the blast furnaces. Ramming, drying, casting, stripping, cooling, cleaning and shipping follow in regular order and are expedited by two 20-ton and two 25-ton cranes in the main bay.

In recent years the ever increasing demand for highly finished sheets, cold rolled stock and material suitable for deep drawing and pressing has been reflected in the methods adopted in the manufacture and design of in-

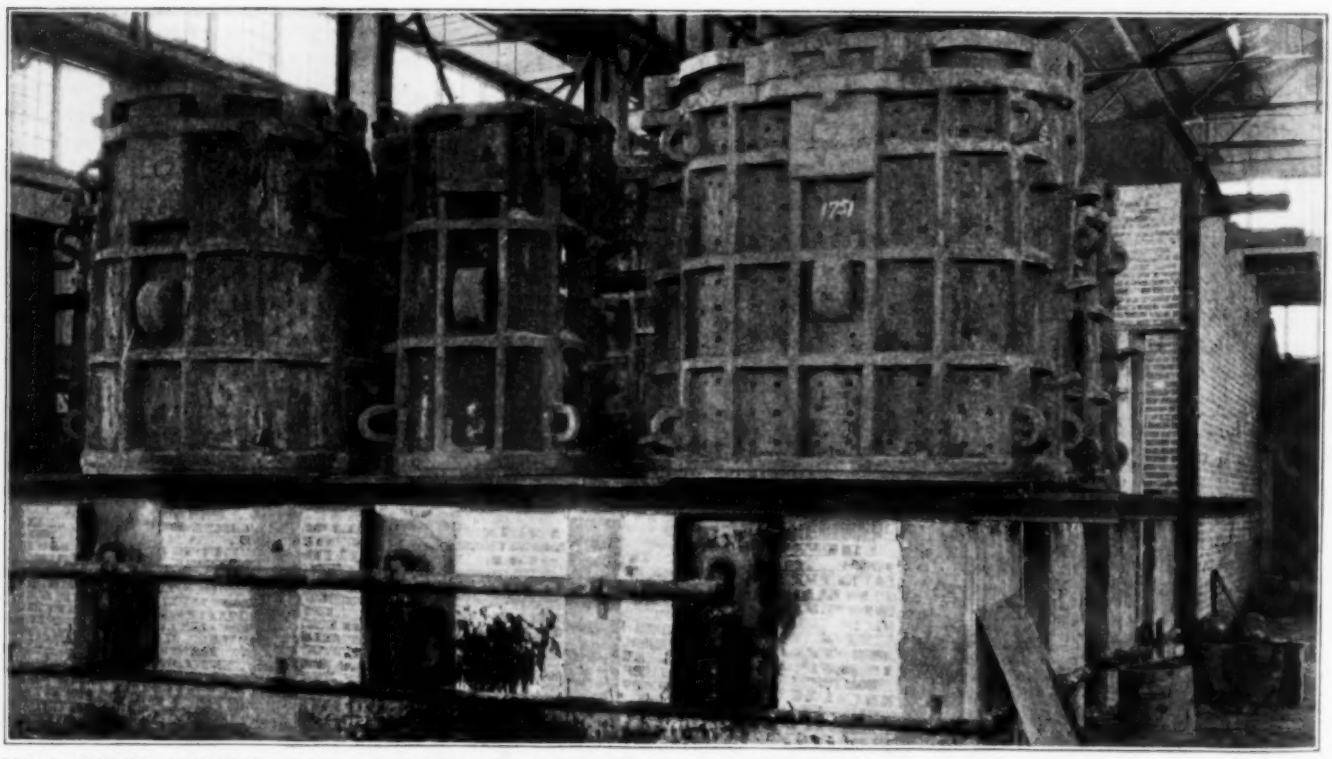


FIG. 2—CHEEKS ARE DRIED OVER A BATTERY OF OIL BURNERS. CORES ARE SUSPENDED BY THE NECKS IN THE OVEN SHOWN TO THE RIGHT AT THE BACK OF THE CHEEKS

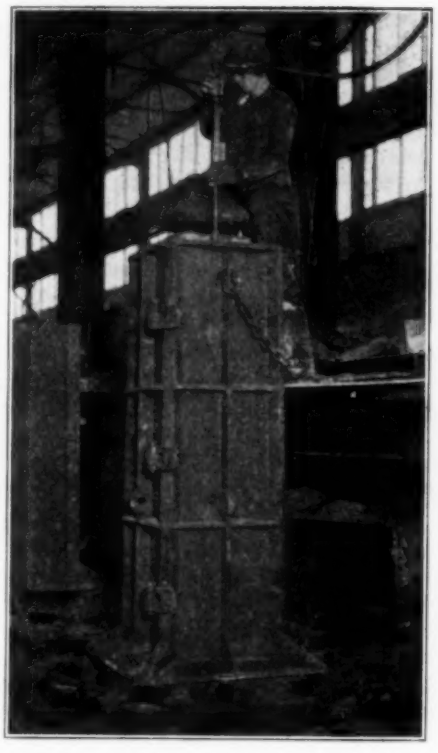


FIG. 3—THE CORE BARREL IS ENCLOSED AND RAMMED UP INSIDE A HINGED, CAST IRON COREBOX

gots. The steelmaker has found that the shape of the ingot and the design of the ingot mold exert a marked influence on the resulting product. Designing ingots and ingot molds is as highly specialized as the designing of rolls. The steelmaker is co-

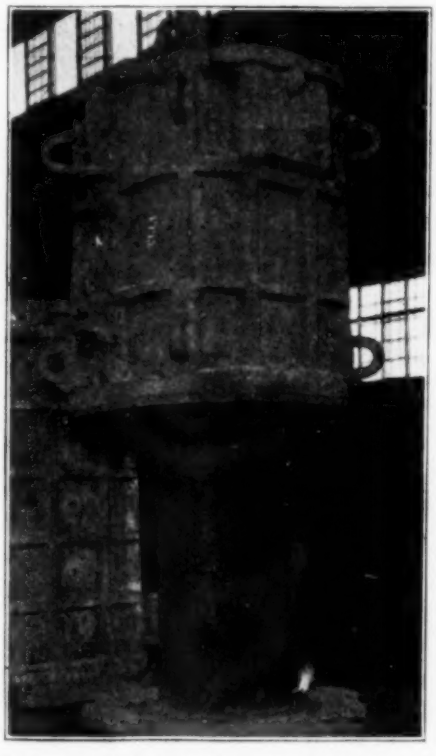


FIG. 4—SUITABLE DOWEL PINS IN THE BASE GUIDE THE CHEEK INTO PLACE AND INSURE AN EVEN THICKNESS OF METAL

operating with the ingot mold manufacturer in the production of molds that are properly balanced. It is claimed that the new plant of the Valley corporation is equipped throughout with carefully designed and substantially constructed molding equipment to assure accurate taper and uniform wall thickness in the molds. Typical pieces of equipment and method of application are shown in the accompanying illustrations.

Equipment Is Substantial

One of the core barrels, shown in Fig. 7, is smeared with claywash or paste and, therefore, the numerous vent holes are concealed. A square tapered tray at the bottom of the barrel is rammed full of sand to form a sand bottom for the mold. Several fitting strips on the outside of the base guide the barrel accurately, first into a recess in the base of the corebox and later into a similar recess in the base on which the mold is assembled for pouring. One of the cores in the latter position is shown in Fig. 5 and another in Fig. 4.

General features both in construction and method of operation of the cast iron, two part, hinged corebox may be noted in Fig. 7. The two parts are pivoted on a suitable pin at the back and the weight is supported on several small rollers on the base while the two halves are opening and closing. A dowel pin set in a central block at the front of the base limits the travel of each half. The two halves are held together during the ramming operation by three clasps on one half the box which engage three corresponding projections on the second half. This feature is illustrated more clearly in Fig. 3.

A pneumatic rammer with an extension shaft is employed to ram the sand. The upper end of the rammer is attached to a small rope which runs over a pulley to a counter weight. This balanced arrangement takes most of the weight and strain off the hands of the operator. One man rams the core while two men usually are employed on the mold.

Sand is prepared in the bay adjoining the main bay where the molds and cores are rammed. Sand from the shakeout station is lifted by a ¾-yard clamshell bucket attached to a 10-ton crane and deposited in a screen and mixer made by the Stephens-Adamson Mfg. Co., Aurora, Ill. The proper amount of new sand is added to each batch. From the mixer the tempered sand is dropped into a concrete bin, then elevated and passed through a muller made by the National Engineering Co., Chicago. Discharged from

FIG. 5—A DRIED CORE AS IT APPEARS BEFORE THE CHEEK FLASK IS LOWERED DOWN AROUND IT

this machine the sand is again lifted in the clamshell and deposited on the platform where the ramming crew stand in a row back of the molds and coreboxes.

After the cores are rammed they are carried by the crane to the finish-

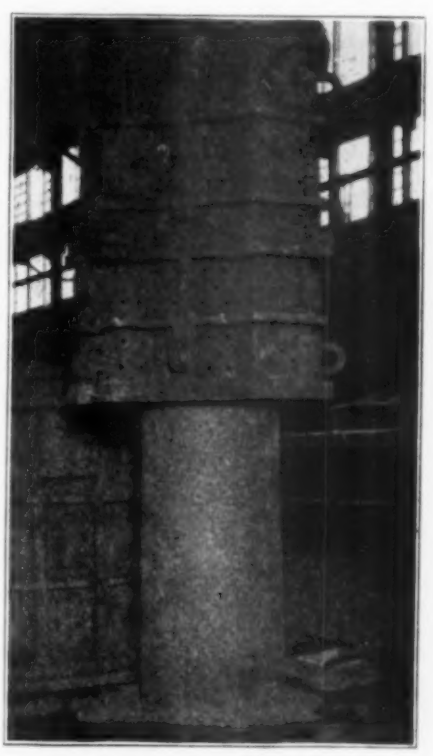


FIG. 6—BASE PLATE OF THE CAST IRON PATTERN IS PROVIDED WITH DOWEL PINS TO GUIDE THE STRIPPING PLATE

ing rack where they are blacked and slicked and then are lowered into the core ovens shown at the right in Fig. 1. Instead of resting on their bases they are suspended by the necks from suitable hooks or by bars placed under the shoulders. Four ovens, each with a capacity of eight normal cores, are provided. The ovens are oil fired and are provided with roller bearing covers easily operated by the men who attend to the loading and unloading. The ovens are kept at a temperature between 500 and 600 degrees Fahr., which is sufficient to dry the cores in from 3 to 4 hours. The dried cores are taken to the casting station where they are lowered into the bases referred to previously and which automatically center them in relation to the cheeks or jackets.

FIG. 7—THE HOLLOW BASE SURROUNDING THE BOTTOM OF THE CORE ARBOR IS FILLED WITH SAND TO FORM THE BOTTOM FACE OF THE MOLD. THE BASE IS PROVIDED ON THE OUTSIDE WITH FITTING STRIPS WHICH GUIDE IT ACCURATELY INTO PLACE

Ingot mold flasks are split in two to facilitate removal from the casting. Some are assembled as single as shown in Fig. 2 while others are built up of two or more sections as may be noted in Fig. 6. A substantial steel stripping plate is attached to the bottom of the flask to insure a clean lift from the stationary pattern. This plate also is provided with dowel holes to fit over dowel pins in the pattern base plate and corresponding pins in the base on which the mold is assembled. The pins are short and pointed.

After the cheek is rammed it is lifted from the pattern and carried to the finishing station where it is blacked and where the gate is cut at the bottom. The upright runner is formed in a pocket in the flask extending from top to bottom and provided for the purpose. The cheek then is lowered on to the drying platform where it is dried over an open flame. Four rows of these individual burners are provided with five in each row thus accommodating 20 cheeks. The usual drying time is between 2 and 3 hours.

Eventually the cheek is taken to the casting station where it is lowered over the core already in position on one of the bases. The dowel pins guide it accurately into place and insure a uniform thickness of metal in the walls of the casting. The stripping plate remains in position on the bottom of the cheek until after the casting is poured. It rests on the rim of the base surrounding the core barrel and on the base supporting the entire mold and thus forms an iron to iron contact that prevents the hot metal from running out at the bottom. The molds are poured without copes.

Low-phosphorous malleable hot metal is brought from the blast furnaces in a 45-ton ladle and is poured into 12-ton bottom pour foundry ladles which in turn are taken by the crane to the casting station. The ladle man stands on a raised platform as shown in Fig. 2 and manipulates the ladle in the same manner as the ladle is handled in the open hearth or bessemer department when pouring into the molds.

A 25-ton crane is available for handling loads in the green sand bay where the stools and miscellaneous castings are made. A second 25-ton crane is provided in the bay where the flasks, patterns, coreboxes, bases and core barrels are stored when not in use. The various bays are connected by industrial railroad and transfer cars from one bay to another.

Shower baths and lockers are provided for the employes in a brick building located on the river side of the main building. A second brick structure houses the office at the shipping end of the main building.

William Robert, general superintendent of the corporation, has appointed E. L. Raysor superintendent of the new plant. George L. Morrow, district sales agent, has charge of orders and shipments, and Thomas Bernhardt, assistant purchasing agent, has charge of all local purchases.

Facing Sand Mixture for Dry Sand Molds

Question: Will you kindly give us a formula for a good facing sand mixture for dry sand and skin dried molds?

Answer: No definite formula can be laid down for mixing facing sand that will apply universally. This readily is apparent when you consider the difference in physical characteristics and chemical composition between grades of sand from various deposits. Thus a formula which specified one part binder to ten parts sand might work satisfactorily with a fairly open-grain sand. The same amount of binder with a fine sand would cause buckles and scabs on the face of the mold. With a coarse open sand containing a minimum of natural binder, 10 per cent artificial binder would not be sufficient. The face of the mold would crumble at the slightest touch and the sand in front of the gates

would wash before the erosive action of the stream of metal

Any sand that will make satisfactory green sand molds will make equally satisfactory dry sand molds if due allowance is made for the fact that the addition of a certain amount of binder decreases the porosity. For example if sand in the green state must be vented extensively, then it will be necessary to add sharp sand to the dry sand mixture to offset the closing effect of the artificial binder. With a knowledge of this fundamental fact it is possible to *doctor* any grade of sand. However, suitable grades of natural sand are available in nearly all parts of this country and a foundryman has no need to compound mysterious mixtures.

Where the sand is prepared mechanically, for example in a pan mill, any good grade of open sand may be mixed in varying proportions of new and old sand. The amount of new sand will range from 10 to 50 per cent, depending on the size and shape of the proposed mold. Any kind of binder may be used but it must be added with due regard to its binding power. The ideal dry sand facing is one that will bake hard and firm and at the same time retain a maximum of permeability for the escape of gas generated when the mold is filled with metal.

Plan Molding Contest for Apprentices

THE American Foundrymen's association always has realized and maintained that the human element is the most important factor in the successful operation of a foundry, as well as in all other undertaknigs. In compliance with this principle the organization actively has promoted apprentice training and other recognized methods of building up, in the United States, a body of men skilled in molding and melting.

During the last few years, apprenticeship has taken on a new importance in all industries and conditions in the foundry industry are such that foundrymen should be active in this movement. The American Foundrymen's association has established a permanent apprenticeship committee and is making all possible efforts to keep the subject of apprenticeship before its membership.

To encourage apprentices and to direct attention to apprentice training work, a contest in molding for foundry apprentices will be held in connection with the 1926 convention of the American Foundrymen's association at Detroit.

At the convention in Milwaukee in October 1924, such a contest was conducted for foundry apprentices in Milwaukee with satisfactory results in every way. A committee of Milwaukee foundrymen were in charge of the contest. They selected castings to be made in competition by apprentices in various divisions, a board of judges composed of visiting foundrymen was appointed and the contest was held in the foundry of the Milwaukee Vocational school. Substantial cash prizes were awarded.

This year the contest will be held on a national scale. The apprenticeship committee of the association has selected patterns to be made in competition in both the steel and the gray iron division. Blueprints of these castings are available which clearly indicate the manner in which the patterns are to be made. Local contest will be sponsored by branches of the American Foundrymen's association or other recognized organizations of foundrymen or manufacturers. The best castings from each local contest will be forwarded to the convention in September where a board of judges will select the best casting in each division. Each casting will be marked with a number instead of the name of the contestant and the time required to finish the mold will also be indicated for the information of the judges.

The contest will be held according to regulations which have been established by the American Foundrymen's association, of which the following are the most important:

Preliminary Regulations

The final judgment and awarding of prizes for this competition shall be at the annual convention of the association.

Local contests shall be held under the auspices of sectional foundry associations or similar recognized organizations to determine castings which are to be sent to the national convention for this competition. Local organizations shall appoint committees for this purpose.

The term foundry apprentice shall be understood to mean an apprentice actually indentured on a contract.

General Regulations

Castings for each class of competition shall be chosen by the apprenticeship committee of the American Foundrymen's association and blueprints of these castings shall be sent to local committees so that patterns and core boxes may be made. Special instructions shall be issued for patternmakers if necessary to make the contest as uniform as possible.

Judges for the local contests and for the national competition shall be distinct from local and national committees. A complete report of the competition shall be filed with the secretary of the American Foundrymen's association at the time of the national convention.

Each foundry will be permitted to enter two contestants for each 25 foundry apprentices or fraction thereof actually employed on the day of the local contest. A corporation operating a steel and gray iron foundry or any two types of foundries shall be considered as having two foundries in the meaning of this regulation.

The cost of patterns, core boxes, metal, sand and other equipment required for the local contest shall be borne by the local organizations.

Local contests must be held at such a time before the date of the convention that the castings will arrive at the convention in time for the opening of the exhibit.

Judges of the local contest shall choose the best three castings in each class to be sent to the convention. Choosing shall be on a basis of general excellence, including speed, workmanship of the mold and quality of the casting. The precise method of judging shall be determined by the local judges but the actual decisions shall be made by each judge independently of the others.

Castings shall be sand blasted but shall not be ground or chipped nor shall risers and gates be removed.

Regulations for the Local Committees

The local committee shall arrange a suitable time and place for the local contest and shall announce the same to all concerned.

The local committee shall manage the contest in all details and shall make all arrangements for sand, metal, flasks, patterns, cores, clamps and all other details of equipment necessary for the contest.

The local committee shall select and notify the judges and shall give them full instructions at least one week before the holding of the contest.

The local committee shall send the winning castings to the convention, in care of the chairman of the apprenticeship committee and shall send to the apprenticeship committee a sealed list of contestants and their corresponding numbers which lists are not to be opened until the judges at the convention have selected the winners.

Further information regarding this contest together with a full set of regulations and blueprints of castings may be secured from C. E. Hoyt, secretary, American Foundrymen's association, 140 South Dearborn street, Chicago.

Simplify Ferroalloy Additions

Plotted Curves Permit Visualizing Additions of Various Metalloids Added to the Charge to Produce Desired Product

By R. S. Kerns

CURVES or charts of various descriptions have been used for years to present in a concrete way statistics, data, etc. It is much easier to see the changes brought about by different conditions when plotted with two or more variables than to visualize the change when the data or figures all are set down in columns.

The manufacturer uses a curve to show his daily production, his daily shipments, his purchases and sales. He then is able to tell from a glance at his curves whether his production is increasing or decreasing each day, without wading through a lot of figures or daily balances.

Curves are interesting and when kept in good form present the whole story in a clear legible manner. The writer knew a classmate at college who might be said to have had the *curve bug*. He made curves to show his weekly, monthly, and yearly expenditures while attending college; a curve of the temperatures taken every morning at 7:00 o'clock; a curve showing the amount of time put on each study during his entire college career.

The writer was interested in a list of constants given by Mr. Quinn in the April 1, 1926 issue of THE FOUNDRY, to be used as a quick method for determining the weight of ferroalloys to be added to a heat of iron or steel when the weight of the charge was known and the percentage or *points* of alloy desired in the final product. These constants are limited to a predetermined percentage of alloy in the ferroalloy, as, 80 per cent manganese in ferromanganese, 50 per cent silicon in ferrosilicon, etc. Should the percentage of alloy run above or below these values, the constants would be of no use. While ferromanganese and ferrosilicon run fairly uniform in their alloy content, yet some of the ferroalloys vary quite a bit, as ferrochromium which varies from 60 to 70 per cent chromium, ferrotungsten varies from 70 to 80 per cent tungsten, ferrovanadium varies from 30 to 40 per cent vanadium, this also holds for the carbon content of the various ferroalloys. Thus, it is not possible to use the constants for values other than those for which the constants were calculated. By a curve or chart these intervening values may be ascertained at once. The writer has prepared a series of curves or a chart which gives the required weight of alloy addition to any weight of charge when the weight of charge, the percentage of alloy in the ferroalloy, and the number of points the alloy is to be raised, are known.

Explanation of the Chart

The different columns and rows of figures have been designated as *A*, *B*, *C*, *D*, and *E*. On the left hand side of the chart we have column *A* which is the *weight of the charge in pounds;* column *B* represents the *percentage of alloy in the ferroalloy or carbon in pig iron*, in fact any percentage of any element can be found in this column. Along the top of the chart in row *C* which is the *pounds of ferroalloy or pounds of pig iron* (in case carbon is to be raised) *to be added to the heat for every* 1000 *pounds of charge*, these weights continue down the right hand side of the chart. At the bottom of the chart it will be noticed the figures are used for two purposes, namely, row *D* contains the *points the element is to be raised* to meet the final analysis, and row *E* shows the *weight of ferroalloy or pig iron to be added to the charge shown in column A.*

The following examples will serve to show how the chart works:

Example 1. Having a heat of 1000 pounds in the furnace and the chemist reports the manganese to be raised 70 points. The ferromanganese containing 80 per cent manganese. To find the weight of ferromanganese required: Opposite line *D* at the bottom of the chart go over to 70 then project straight up this line to the horizontal opposite 80 in column *B*, now move up between the two diagonal lines to the top of the chart, and on line opposite *C* read 8¾ pounds, which is the weight of ferromanganese required to raise the heat of 1000 pounds 70 points.

Example 2. If the heat is 6500 pounds instead of 1000 pounds, then don't go up between the two diagonal lines as you did in Example 1, but go down between these two diagonal lines until you intersect the horizontal line opposite 6500 in column *A*, then drop straight down to the weights shown in row *E*, which will read 57 pounds, or it will require 57 pounds of 80 per cent ferromanganese to raise a heat of 6500 pounds 70 points.

Example 3. Raise the silicon in a heat of 8800 pounds 20 points. The ferrosilicon to contain 50 per cent silicon. At 20, opposite the *D* line of figures, project up to opposite 50 in column *B*, follow the diagonal line upward from the intersection of lines 20 and 50 until you intersect the line 8800 opposite column *A*, now drop straight down to row *E* and read 35 pounds, or it will take 35 pounds of ferrosilicon to raise a heat of 8800 pounds 20 points.

Example 4. What weight of nickel will be required to give 3.50 per cent nickel in a 9000-pound heat? The nickel pig or shot used contains 98 per cent nickel. Project up from 35 on the row *D* to intersect line 98 in column *B*, then drop back along the diagonal line to line 9000 opposite column *A*, drop down vertically from this point and read 32 pounds at the bottom of the chart. Now this weight must be multiplied by 10 to give weight of nickel required for 350 points instead of 35 points as was assumed at first. This makes the weight of nickel required, 320 pounds to give 3.50 per cent nickel in a heat of 9000 pounds.

Example 5. Should the melter wish to know how much the carbon was raised in Example 2, by adding 57 pounds of ferromanganese to the heat of 6500 pounds, it can be determined as follows: The ferroalloy in question contains 6 per cent carbon. From 57 pounds at the bottom of the chart, go straight up to the weight of the charge or 6500 pounds, follow down between the diagonal lines from this point until the line opposite 6 in column *B* is reached, then drop straight down from here to the *points* row and read 52 points. Thus it will be seen that the 57 pounds of ferromanganese added to the heat raised the carbon 52 points.

It will be noticed in column *A* the charges run from 0 to 10,000 pounds. Should a charge be more than 10,000 pounds all that is necessary is to select the charge which will be 1/10 of the weight, in column *A*, for instance, should the heat weigh 26,000 pounds, the weight of the alloy required would be read from the weight of 2600 pounds charge and the resulting weight of ferroalloy as found then would be multiplied by 10, this would give the weight of ferroalloy required for the heat of 26,000 pounds. From this it can be seen that there is no limit to the weight of the

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in notebook form.

Patternshop Geometry

By Walter C. Ewalt

Fig. 1 is a heptagon, has seven sides, the angles at the center are 51° 26′. The angles of adjacent sides at *C* equals 128° 34′. Multiplying the radius *R* by 0.8676—in column 5, Table I will give the length of a side as at *B*, Fig. 1. Multiplying the length of a side *D*, Fig. 1, by 1.0383 in column 6 Table I will give *R*, in Fig. 1 and the

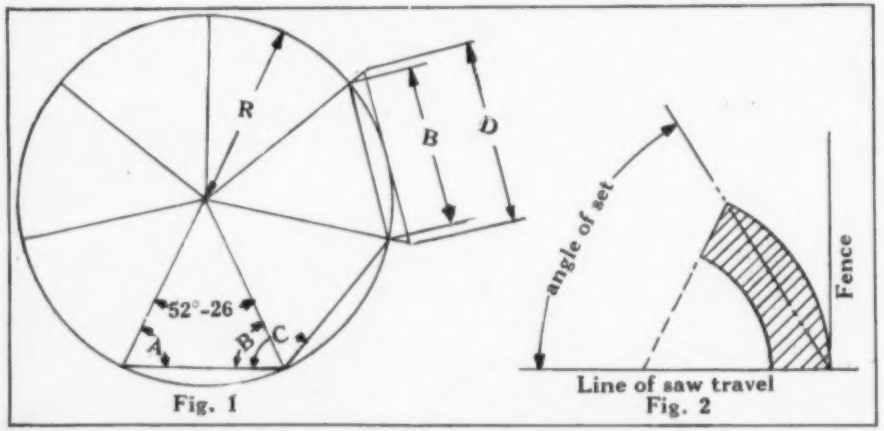


Fig. 1 Fig. 2

FIG. 1—A HEPTAGON SHOWING THE VARIOUS ANGLES AND DIMENSIONS USED IN LAYING OUT THE PATTERN. FIG. 2—IN SAWING THE SEGMENT FOR A REGULAR POLYGON THE ANGLE OF SET MUST BE EXACT TO OBTAIN A GOOD JOINT

angles to hold the work in cutting the ends of the segment under column 7 Table I is 64° 17.5′ and is shown in Fig. 2.

Referring to Table I, the 51° 26′ is obtained by dividing 360° by 7 which equals 51° and 3° over—multiplying 3 x 60 equals 180 minutes which divided by 7 equals 25.5 or nearly 26 minutes—the answer then is 54° 26′.

(*Continued on Data Sheet No.* 628)

Patternshop Geometry

(*Continued from Data Sheet No.* 627)

Fig. 3 illustrates the number of degrees in a triangle and square. The sum of the angles of a square equals 4 x 90 or 360°. The triangle shows 90 plus 45 plus 45 equals 180°. Any triangle then has 180° regardless of shape.

Referring again to Table I, column 4. As the sum of the angles is 180° and as one

TABLE I

Data for Regular Polygons

Name of Polygon	Number of Sides	Angles at Center	Angles Between Adjacent Sides	Side of polygon Inscribed in Circle	Radius of Inscribed Circle	Angle of setting stop
Triangle.....	3	120°	60°	1.732	0.2887	30°
Square.....	4	90°	90°	1.4142	0.5	45°
Pentagon....	5	72°	108°	1.1756	0.6882	54°
Hexagon.....	6	60°	120°	1.000	0.866	60°
Heptagon....	7	51° 26′—	128° 34′	0.8676	1.0383	64° 17.5′
Octagon.....	8	45°	135°	0.7653	1.2071	67.5°
Nonagon.....	9	40°	140°	0.684	1.3737	70°
Decagon.....	10	36°	144°	0.618	1.5388	72°
Undecagon...	11	32° 43′+	147° 17′	0.5634	1.7028	73° 38′+
Dodecagon...	12	30°	150°	0.5176	1.866	75°

angle is known as 51° 26′, then the sum of the angles *A* and *B* equals 180° minus 51° 26′ or 128° 34′ which is also the same as angle *C*.

Tables II and III will be found convenient to patternmakers especially in allowing for draft and in laying out geometrical figures. Table II is illustrated by Fig. 4.

Table III with Fig. 5 is self explanatory. Many of these figures are used in making the draft on patterns and often drawings will come to the shop showing tapers of castings wanted. An order may be made out for a certain taper per foot on a side which means the angle with center line or it may specify total taper or the included angle. If the drawing calls for a certain number of degrees, it is understood to mean the included angle or total taper.

(*Continued on Data Sheet No.* 629)

Around the World with The Foundry

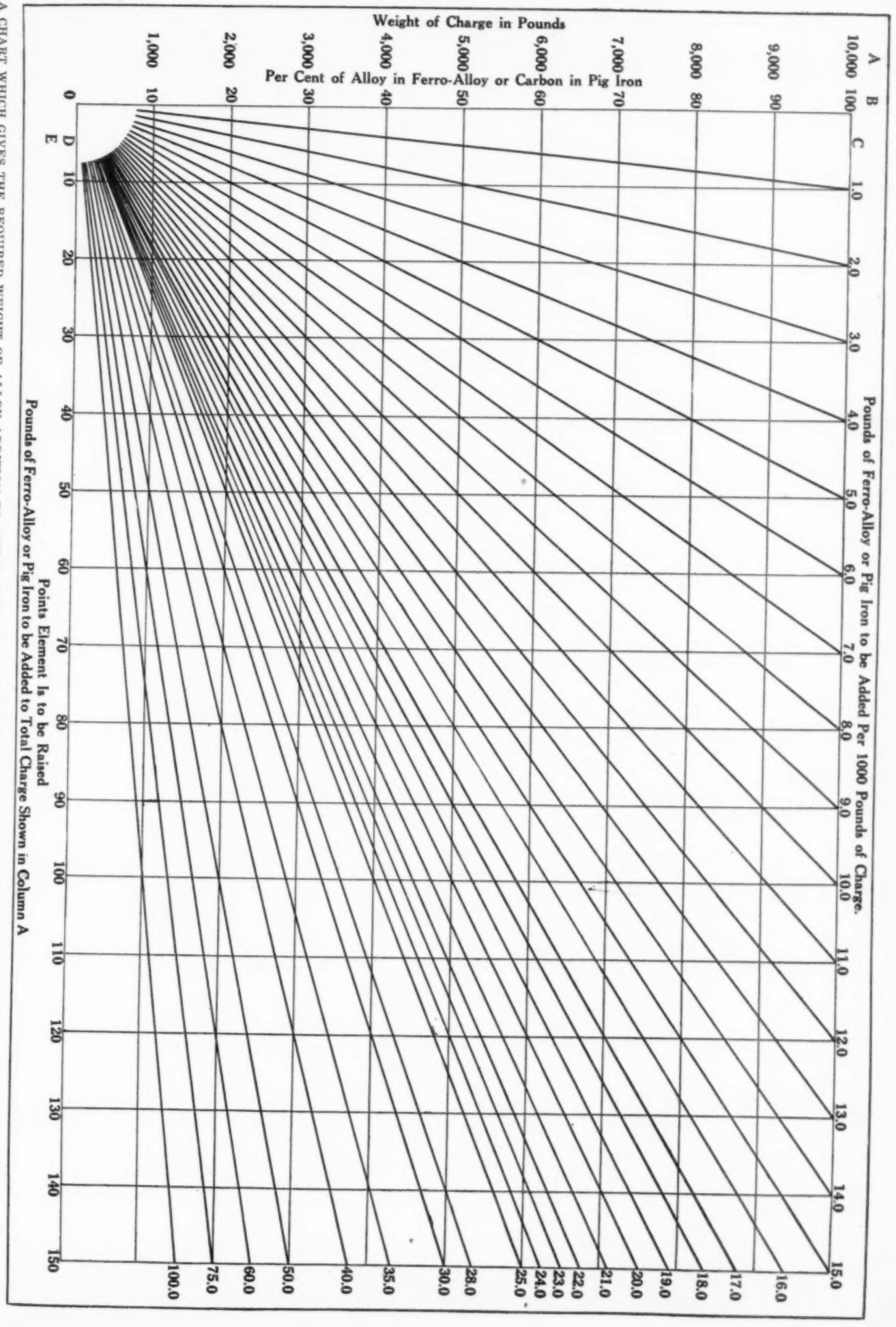
Little Journeys to the homes of our readers

Switzerland

WHILE the world revolved in the lathe of time and the hot lands heaved amain; and again, for several thousand years followed the dictum that while the earth remained, seed time and harvest time, heat and cold, summer and winter, day and night should not cease; the question of measuring time received little consideration. Industrial conditions in the middle ages brought with them the necessity of adopting a more accurate and scientific method of measuring time than that afforded by the constellations wheeling in the arching dome of the firmament, the resplendent passage of the sun by day, the tranquil beauty of the moon in its many phases by night, or, the changing seasons of the year.

Although not the originators of watches and clocks and other time measuring devices, the Swiss early began their manufacture and in time attained an international reputation for beauty, finish and accuracy of their product. Watches still represent a considerable proportion of industrial activity, but the republic which is 57 per cent agricultural, has many and diversified manufacturing plants. The foundries are operated in a highly competent and modern manner and therefore it is not surprising, that although the inhabitants speak four different languages, no one of which is English, still THE FOUNDRY finds its place twice a month on the desk of those responsible for the operation of 13 of the most prominent foundries in the country.

"Wherever metals are cast you'll find THE FOUNDRY"



A CHART WHICH GIVES THE REQUIRED WEIGHT OF ALLOY ADDITION TO ANY WEIGHT OF CHARGE WHEN THE WEIGHT OF THE CHARGE, THE PERCENTAGE OF ALLOY IN THE FERRO-ALLOY AND THE NUMBER OF POINTS THE ALLOY IS TO BE RAISED, ARE KNOWN

charge to which this chart is applicable.

The weights of ferroalloy and pig iron obtained from the chart do not take into account the melting loss of the alloy, but are based on 100 per cent efficiency or absorption of the alloy. Some melters have alloy losses of 10 per cent, others 15 per cent, and still others run as low as 5 per cent, all depending on the character of the ferrolloy; if fine or in large lumps, whether it is added to the ladle or the furnace. Most melters know what their losses are and can allow enough in addition to the weight found from the chart to make up for them.

In the chart accompanying this article, the small divisions on the left hand side of the chart have been omitted. Each division represents 2 per cent or 200 pounds, as between 40 and 50 they would be 42 per cent, 44 per cent, 46 per cent, and 48 per cent, or 4200, 4400, 4600, and 4800 pounds. At the top of the chart, also omitted, each small division represents 0.2 pounds, or between 6.0 and 7.0 they would be 6.2, 6.4, 6.6, and 6.8 pounds. At the bottom of the chart the small divisions represent 2 points or pounds, as between 50 and 60 they would be 52, 54, 56, and 58 points or pounds depending upon the result sought.

A chart of convenient size could be constructed and hung under glass near the furnace where the melter would have ready access to it; a good size would be 3 feet wide and 2 feet high. Care should be taken in deciding where the diagonals above 15 cross the right hand vertical line.

With a little practice, the melter would be able to tell almost at a glance, without any calculations whatever, what weight of ferroalloy is to be added to the heat to bring the alloy in question to its required percentage, or the weight of pig iron required to raise the carbon to the desired figure.

Survey Malleable Furnace Refractories

THE joint committee on foundry refractories composed of various organizations interested in the subject of refractories, is conducting a survey of service conditions of refractories used in different branches of the foundry industry. Subcommittees, composed of representative foundry managers and metallurgists, have been appointed by the joint committee to arrange the detailed work connected with the surveys and to report to the joint committee at its meeting to be held in connection with the Detroit convention of the American Foundrymen's association.

A subcommittee studying malleable foundry refractories is asking that the malleable foundry managers co-operate by supplying such information as each manager may contribute. To aid the foundry managers in supplying this information, the committee is sending to each foundry a questionnaire which will be easy to fill out and yet supply the needed data. The questionnaire forms the basis for a systematic study for improvement in composition, manufacture, specifications, testing, and application of reverberatory furnace refractories.

After the data of the questionnaire are analyzed, it is proposed to have field men investigate more fully certain phases of the work. The subcommittee conducting the malleable furnace service conditions survey is composed of: James R. Allen, International Harvester Co., Chicago, chairman; H. M. Thompson, H. M. Thompson Co., Chicago, and J. H. Birdsong, National Malleable & Steel Casting Co.

The joint committee on foundry refractories was organized by the American Ceramics society upon the recommendation of the American Foundrymen's association in 1925. At the present time, twelve national organizations are co-operating in this undertaking by having a representative on the committee as follows: The American Ceramics society; the American Electro-Chemical society; the American Foundrymen's association; the American Malleable Castings association; the American Refractories institute; the American Society for Testing Materials; bureau of mines, United States department of commerce; bureau of standards, United States department of commerce; division of simplified practice, United States department of commerce; Electric Steel Founders Research group; Institute of Metals division American Institute of Mining and Metallurgical Engineers, Steel Founders' Society of America.

Subcommittees of the joint committee in addition to the one on the survey of service conditions are: Subcommittee on testing and specifications, subcommittee on standardization and simplification.

Plan Standardization in Plumbing Industry

Representatives of a number of makers of plumbing equipment, meeting June 9 under the joint auspices of the division of simplified practice and the national metals utilization committee of the department of commerce took initial steps toward the simplification of trap screw ferrules used in plumbing fittings, laid plans for a survey of variety, and indicated a desire to seek the sponsorship of the national trade extension bureau of the plumbing industry.

At the meeting, which was presided over by Edwin W. Ely, it was disclosed that there are some 12 or 15 types of this product in common use; but that there are more than 50 special types required under the plumbing codes of various communities. Each of these variations, it was disclosed, causes a loss of from 2 to 3 hours of labor in the changing of patterns, etc., all of which expense is passed on to the ultimate consumer. Other variations of style, size of thread, weight, size of opening, were disclosed as adding to the costs. One speaker pointed out that a ferrule required by the city of Baltimore is a pound in weight heavier than that used in Washington. It was also shown that municipal requirements are not followed in suburban communities.

The objectives of the building code committee of the department of commerce were explained by George N. Thompson, who outlined the co-operative efforts of the bureau of standards and other governmental branches in seeking the most modern plumbing standards.

Those in attendance included the following manufacturers: George H. Derbyshire, the Sanitary Co. of America, Philadelphia; T. B. Robbins, Medina, N. Y., representing the Bignall Co. and A. L. Sweet Iron Works; John Heinkel, Rock Island, Ill., representing the Blake Specialty Co., and J. Stuart Reynolds, of Richmond, Va., representing the Richmond Foundry & Manufacturing Co.

Communications from a dozen other manufacturers and the National Association of Master Plumbers showed a unanimous sentiment in favor of eliminating the existing overdiversity and of concentrating on a few styles and sizes of the products used in the plumbing industry.

Brass Shop Uses Conveyors

Fig. 1—A Portion of the Molding Floor Showing Conveyors, Benches and Molding Machines, as Well as the Pouring Operations on the Far Side

By

E. C. Barringer

ALL of the molding, pouring and handling operations of brass foundry melting up to 6000 pounds daily have been concentrated in the small space of 24x72 feet in the new Chicago factory and warehouse of James B. Clow & Sons, manufacturer of general plumbing and heating supplies. Including the melting, metal storage, cleaning and grinding departments, the foundry proper measures only 65x72 feet. This foundry is located on the fifth floor of the manufacturing plant.

Practically complete mechanicalization permits this unusual economy of space. The products of the foundry include bibbs, faucets, cocks and other similar plumbing supplies, and special castings for ultra violet ray sterilizers, all of which enter into installations made by that company. The average casting weighs 12 ounces and 20 ounces is the maximum. In some cases more metal is required for the gates than for the castings, so that 60 per cent in castings is a good return for the day's melt.

No special problems are encountered in making the patterns, which are mounted on plates because of the character and size of the work, or in making the cores, which are baked in a 5-rack gas fired oven. The installa-

Fig. 2—Many of the Molds Are Made on Machines and Then Are Loaded Upon the Conveyor

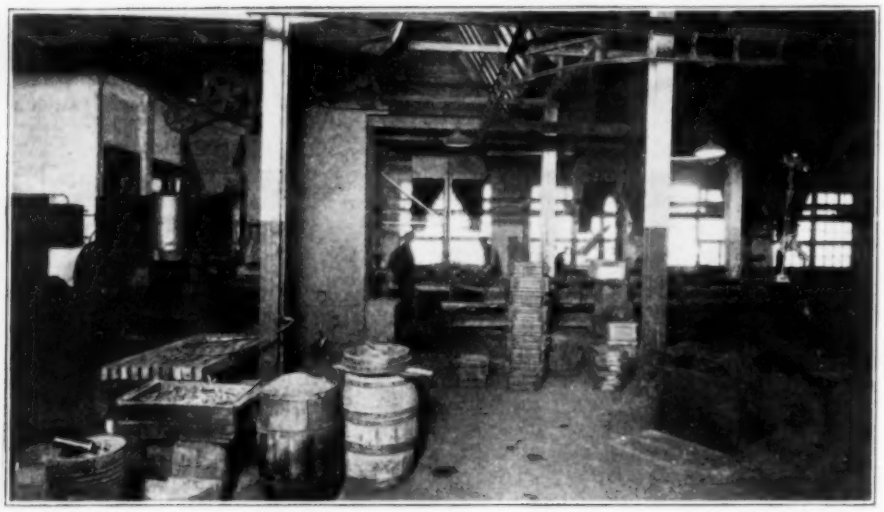


Fig. 3—The Molds Are Shaken Out at the End of the Conveyor and the Sand Is Sent to the Mixer

tion of an automatic gas regulator is a scheduled improvement in the core-room.

The conveyor system and the sand handling equipment are the interesting features of this plant. A general idea of the layout of the conveyor system may be gained through a study of Figs. 1, 2 and 4. The roller gravity conveyor extends along one side of the floor, across the end and down the other side. Nine molding stations are within the enclosure of the conveyor system, which measures 13 feet from the inside of the loading station to the inside of the pouring station. Four of the stations are provided with hand benches, three with air squeezers and two with hand squeezers. A 1½ yard steel sand storage bin is located above each molding position. The molding stations are located much nearer the loading than the pouring station. A gravity conveyor on which the flasks are returned from the shakeout is between the pouring station and the molding floors.

An idea of the operation of the equipment may be gained by following the sequence of operations in making the brass castings. The molder takes the flask and bottom board from the return conveyor, which runs adjacent to his station. The mold is completed, either by hand or on the machines, and is set on the loading section of the conveyor. It is not necessary for the molder to leave his station to secure the flask or to place the mold on the conveyor. The taper on the conveyor is not sufficient to permit the molds to be free running and it is necessary to shove them around the end conveyor to the pouring station.

At the outset it was planned to pour every 20 minutes, but every 50 to 60 minutes has been found more economical. A monorail expedites the movement of metal from the furnaces to the pouring section. The average cooling time is 10 to 15 minutes. From the end of the pouring section to the shakeout is scarcely 15 inches; just sufficient space to permit a workman to take the flasks off the conveyor and with a twist of his body overturn them on the shakeout screen. The shakeout is shown in the center of Fig. 3.

The flasks which are not broken, and the bottom boards are placed upon the return carrier. The sand, on passing through the shakeout screen, is scooped up in the buckets of an elevator shown in Fig. 3, and at a height of 13 feet 11 inches falls through an aerator into a measuring

Fig. 3—The Molds Are Carried on the Conveyor to the Pouring Station Where a Special Rig Is Used to Pour

hopper. New sand, scarcely a wheelbarrow full a day, is added at the shakeout.

From the hopper, where the batch is measured and water added, the sand falls into a mixer which is shown at the left of Fig. 4. This mixer discharges the sand on a belt which puts it into a second elevator boot. At a height of 19 feet 4 inches from the floor the elevator drops its load into a second aerator which in turn feeds an 18-inch traveling belt. This belt passes over the storage bins. One man is sufficient to attend to every detail of sand handling.

The loading section of the conveyor system is 55 feet long and the pouring section 46 feet, not including the turn. The rollers are seamless steel tubing, 12 inches in width, 2¼-inches in diameter and spaced on 3-inch centers. The legs are adjustable. The elevation of the loading section ranges from 25 to 28 inches and of the pouring section from 22 to 24.

The flask return carrier is 50 feet in length with an elevation ranging from 18 to 30 inches, permitting the empty flasks to be free running. Here the rollers are pipe, 12 inches wide and 2 3/8-inches in diameter, spaced on 4-inch centers. Between the pouring section and the return carrier are benches from which workmen can take the pouring weights without stooping. The flasks are 12 inches wide x 16 inches long x 6 inches deep.

A hand squeezer is located outside the conveying system for handling special work. Eventually a supplementary conveying system will be installed to expedite the pouring of the molds from this machine. Metal is melted in two gas and one electric furnaces. The larger gas furnace has a capacity of 600 pounds per charge and the smaller 300 pounds. The smaller is used for special mixtures and as a crucible heater. The electric furnace has a capacity of 800 pounds per hour.

From the shakeout the castings are handled to a platform where the cores, as many as 24 in one flask, are jarred loose by the application of a chipping hammer. Orthodox operations at the sprue cutter, in a sand blast barrel and at two double grinders prepare the castings for the finishing operations in the machine departments below.

Considering the amount of work, the labor force in the foundry proper is small. The 10 molding stations require one man each. The man in charge of the sand handling equipment also brings up the new sand from bins on the ground floor. One man attends to the furnaces. Pouring and the shakeout require three men. One man cleans the cores and cuts the sprue. Another directs the sand blasting and sorts the castings. Normally four men are on grinding.

The two aerators, elevators and the sand mixer were built by the National Engineering Co., Chicago, and the belt, hoppers and allied equipment by the Link-Belt Co., Chicago. The two elevators are operated by independent 7½-horsepower motors, the mixer by a 10-horsepower motor and the traveling belt by a 3-horsepower motor. In every instance the motors were by the General Electric Co.

The conveyor system was manufactured by the Mathews Conveyor Co., Ellwood City, Pa. The air squeezers are from the Tabor Mfg. Co., Philadelphia, and the hand squeezers from the Arcade Mfg. Co., Freeport, Ill. The core oven was manufactured by the Foundry Equipment Co. and the sand blast with dust arrester by the W. W. Sly Mfg. Co., both of Cleveland. The larger gas furnace was installed by the Monarch Engineering & Mfg. Co., Baltimore, and the smaller by the American Gas Furnace Co., Elizabeth, N. J. The electric furnace is of the induction type manufactured by the Ajax Metal Co., Philadelphia. Pouring is by means of a unit installed by the Modern Pouring Device Co., Port Washington, Wis., the monorail being supplied by the Louden Machinery Co., Fairfield, Ia.

How and Why in Brass Founding

By Charles Vickers

Castings Are Porous

We are manufacturers of bronze, steam and water globe valves producing about one ton of castings per day using coke-fired crucible furnaces of two different types, each taking crucibles holding about 400 pounds. The composition of the metal is about copper 85 per cent; tin 7 per cent; zinc 5 per cent; lead 3 per cent. Heavy scrap is sometimes used alone and sometimes with ingot metal. In the bottom of each crucible we put about 5 ounces of phosphor copper containing 15 per cent phosphorus, and as soon as the metal is melted we cover the surface with a flux consisting of charcoal and old burnt sand, with a little salt and soda ash mixed in. We pour the molds from ladles holding about 160 pounds of metal, and pour from the furnace into the ladles containing about ¾ ounce of phosphor copper. The pouring temperature ranges from 1050 to 1150 degrees Cent., and we obtain splendid castings. We use molding machines of American make and we dry all the molds.

Our greatest trouble is with porosity, which we have been unable to overcome although we have tried different methods, suggested by reading THE FOUNDRY. *The most difficulty is experienced with valve bonnets, not much with the body castings. The coke contains no appreciable sulphur, but one furnace brings hot air and burnt gases into contact with the metal while melting and we believe this is the cause of the porosity due to oxidation of the metal. The other furnace is better, but having only recently been installed we have no data in regard to its performance. The scrap metal is fine, heavy, naval scrap with old valves, cocks and fittings. Our ingots are doubtful because in our country there are no reliable makers of ingots. Selected scrap and ingot cost the same; about 13 cents per pound. The fracture of the castings is beautiful and of a nicely close grain. The molten metal is usually thinly fluid, but occasionally we get thick metal, a little silvery in which case we do not use it.*

From this description of the methods used we are unable to discover any reasons for the castings being porous, but it is possible the word *porous* is not used in the same sense as we understand it. Our definition of porous is meaning a condition of the metal in which its structure is filled with pores, namely; small holes of a more or less globular shape and produced by gas suspended in the metal. Such a condition might be brought about by the oxidation of sulphur, the latter being a part of the metal, the reaction being brought about by the dissemination of oxide throughout the metal as it was being

melted in the crucible melting furnace.

When brass or bronze is charged into a hopper on top of the furnace and the products of combustion pass through the hopper with the idea of heating the metal therein, to induce more rapid melting, surface oxidation occurs and as the alloy melts this oxide is carried down into the molten bath. Should the metal contain sulphur, sulphur dioxide would be evolved and partly be held in solution by the metal, producing porosity in the castings. To determine whether this possibility exists, an analysis should be made of the scrap and ingot metal to determine the sulphur content. The oxidation of carbon could not produce the same effect of porosity because carbon is not soluble in copper or its alloys to any extent, otherwise charcoal would not be a good covering for melting such alloys. However, porosity is sometimes taken as meaning an open structure of the metal, such as can be sometimes observed in the heart of a heavy bronze bar, such as a square or round bar 2 or more inches in cross section. This is a pithy condition such as is found in the center of a stick of elder wood. The addition of around 1.5 per cent nickel remedies this condition. When it is found in castings of comparatively thin cross section, it is not natural. It generally will be found due to the presence of small amounts of aluminum. Therefore, examine the ingots and scrap for this element. It will cause leakage and the castings will not hold even moderate pressures. The *thick* metal is produced by oxidation. Either aluminum or magnesium or a combination of both will remedy this condition, but it is necessary that neither of these elements be left in the bronze, until it is poured into the molds, as both are harmful as a part of the alloy, though highly efficient cleansers of the same when properly used.

If the ingots are suspected we suggest they be omitted from such castings.

Physical Data on Bronze

We are desirous of obtaining a good formula for bronze or brass suitable for casting fittings for automobile bumpers, used temporarily after getting up patterns waiting for malleables, as this is done in this line of industry.

We would like the best mixture possible for this purpose, also complete data on the same.

The following alloy will be suitable for the purpose outlined and offers no difficulties in making castings: Copper 90 per cent; tin 6.5 per cent; lead 1.5 per cent; zinc 2 per cent. Simply melt the copper under covering of charcoal, and when completely fluid add the white metals. Stir with a pumping motion, cover completely with charcoal, and heat to around 2300 deg. Fahr., or a little better. Cool to pouring temperature after the metal is taken from the furnace. Its physical properties are: Tensile strength from 35 to 40,000 lbs. per square inch; yield point from 18 to 22,000 lbs. per square inch; elongation 25 to 33 per cent in 2 inches; reduction of area, 26 to 34 per cent; specific gravity at 20 degrees Cent, 8.8; brinell hardness number 500, kilogram weight, load for 30 seconds, 50 to 60.

Other data are: Patternmakers allowance for shrinkage, 0.14 inch per foot; weight per cubic inch, 0.32 pound; compression, elastic limit, 13,000 pounds per square inch.

Makes Large Thin Plate

We are planning to make a red brass casting 53 inches wide and 85 inches long which is to be used as a die for forming paneled veneer. This casting is ¾-inch thick and will be ribbed on the back. What we wish to know is, would you recommend ground sea coal for facing, or what would you recommend? We are using double O Albany sand. The working surface of this casting will have to be smooth and clean.

The subject of molding thin large bronze plates such as tablets and the one mentioned in the inquiry has been dealt with at length in past issues of THE FOUNDRY and it would be advisable to refer to these if possible. Thus in the issue of May 1918 page 216-17 there was an illustrated article entitled, "Molding and Casting Ornamental Bronze Tablets." Several other articles also have appeared from time to time.

We would not suggest the use of sea coal for facing the mold for a bronze casting such as the above. The grade of molding sand mentioned is much too fine in our opinion for a casting of the size stated. A No. 2 sand would be about right for such a mold; the face side of the casting can be made smooth by the use of a facing when ramming the mold, or by *printing back* the cope, in which case the face must be cast upwards.

A mixture of two-thirds double O sand and one third No. 2 sand mixed dry and screened through a fine screen can be used for the facing. After the pattern is drawn the mold should be well sprayed with molasses water mixed about one part molasses to 15 parts water. Mix with hot water and allow to cool before use. The facing sand should be mixed the night previous to being used. It should be piled, patted with shovel, watered, and left to mellow. Use virgin metals and no scrap in making the alloy, in order to get clean metal.

Aluminum Plates Corrode

We have had considerable trouble with aluminum squeezer plates corroding. Most of these plates have been stored in our foundry, and it is possible that the varying temperature and steam arising from the sand heaps may be responsible for this corrosion. We expect to erect a pattern storage and would appreciate your suggestions as to whether the plates will be likely to corrode when kept in either a brick or sheet metal building that is not heated.

Yes, the corrosion of the aluminum pattern plates is caused by the steam arising from the sand, and also by the action of the various gases evolved by the casting of metal. In some foundries the aluminum plates are not subject to this corrosion to any appreciable extent because of the general dryness of the atmosphere in spite of the steaming sand. This condition will prevail in shops, well lighted, well ventilated and floored with wood blocks, concrete or brick instead of damp sand.

Aluminum readily is attacked by water, especially when in the cast condition. Little grayish tufts will appear here and there on the surfaces, and underneath these tufts spots will show, which soon become holes. Iron plates under the same conditions would rust away. Aluminum is used because of its lightness making it better to handle, but for permanency a rolled brass or copper plate would be superior to either steel or aluminum, and probably it would be cheapest in the end, for after it had served its purpose, it would have a marketable scrap value.

Aluminum match plates never should be stored in a cold, damp place as the moisture will be condensed on them and will attack, and in time ruin them. A pattern storage should be heated in winter. A brick building is better than a metal one, and safer. The building should be ventilated. Heat will prevent dampness which will corrode the pattern plates and patterns made of iron or aluminum. A well appointed pattern storage is an asset and not a liability.

Mounting Patterns Requires Varied Ingenuity-III

By H. N. Tuttle

SO MUCH has been written upon the stripping plate patterns that little need be said upon this branch of the subject. However, so far as the writer can see, there is a growing tendency to get away from the babbit faced stripping plate, except for gears. Even these often are made with segments of cast iron or sheet brass, filed to fit a few teeth and fastened in a turned seat of the cast iron plate as shown in Fig. 34. Segments made of sheet brass may be scribed around the pattern and cut to shape on an ordinary wood cutting band saw. They require but little hand fitting. Cast iron segments are cast to shape, planed to thickness and the little necessary filing done by hand.

There is a tendency to make the stripping plate thinner where the filing has to be done and thus reduce this time consuming operation. The filing is not as well done as formerly. The writer remembers asking an old timer about 20 years ago how accurately the stripping plate had to be fitted to the pattern. "So it will hold water" was the reply. Nowadays a 1/64-inch crack anywhere around the pattern is tolerated. Another change gradually coming in is—that of moving the stripping plate joint or crack away from the pattern, say 1/32-inch or so. Fig. 32 shows a section of this detail which prevents scratching of the pattern so especially bad in patterns with a babbit stripping plate when the babbit rubs against the pattern. This also is a good plan where wood patterns are used, as the patterns can swell out as far as the stripping plate without causing any inconvenience. On a large wood pattern 1/16-inch is none too much to allow.

In many pan shaped castings, used mostly for covers, cases, etc. deep draw sides with a small band or bead at the bottom are found. A detail section through the side of one of these patterns is shown in Fig. 33. It is better to make the parting at the top of the band, *Q*, rather than at *R*, as is usually done. This makes a truer surface at *R*, and a less height is put in the cope. If the band is too thick, the stripping plate joint should be moved nearer to the body of the pattern. The drag of course is put on a rock-over machine, or rolled over by hand on the floor.

Make Two Patterns

In making this type of pattern, time often is saved by making two castings. One casting is mounted one side up for the stripping plate and the other one is mounted the other side up for the rock-over.

Patterns for the jolt cope strippers are so nearly like the rock-over patterns, that nearly eveything said about that type of patterns will apply to the jolt strippers. It is only necessary to add the *dead plate* and stripping plate of the same thickness between the rock-over pattern and its plate.

Stooling seldom is done on jolt strippers. Ordinarily it is more convenient to use a *ram up* core.

Where it is desirable to stool a jolt stripper it is necessary to hang the support for the stool from the stripping plate, and this raises the flask that much higher from the floor. Fig. 35 shows how this may be done. *A*, is the pattern with *B*, the part to be stooled out. *C*, is the stool supported on the plate *D*, which is hung from the stripping plate *F*, by bolts *EE*. *G*, is the pattern plate which supports the pattern and stripping plate. *H*, is the bumping platen of the machine and *JJ*, are the stripping plate lifting parts. *K*, is the flask, the pins being placed in the pattern plate so they will be out of the way when lifting off the flask.

Another way of lifting out part *B*, besides the ram up core (which probably is the preferable way) is by a lifting plate, made self lifting by a winged stem.

While the general type of rock-over jolt machines have become deservedly popular, yet they have been accompanied by many molding troubles, even after the strictly pattern troubles have been eliminated.

Writing down all the different causes of defective molds, for which the writer has had to hunt reminds him of the trouble chart in the automobile instruction book.

Often the machine operator is inexperienced and when the mold repeatedly tears up he naturally calls for the patternmaker. Therefore the patternmaker should familiarize himself with the various causes of these defective molds.

When the mold tears up he should at first examine the pattern, and if he can find any burr, caused by the rammer, vent wire, or otherwise; or any back draft or rough spot in the location of the tear up, the remedy is obvious. If the pattern is all right, he should then watch carefully the making of a mold. If the sand is rammed excessively hard, as is sometimes done to a pocket or around the edges, there will be a tear up. Try peening the pocket or around the edges, and reduce the number of jolts.

Watch the flask when jolting. If it shows a tendency to a rotary motion instead of straight up and down this is liable to cause a *tear up* on one side, a *ram off* on the other, or both. With the mold for a flywheel, a *ram off* on the inside of the rim as large as a cigar was found in every mold. The cause was found in a rotten foundation under the jolting cylinder, which tilted it out of plumb. On another occasion a pattern with even excessive draft ¼-inch in 1-inch—always tore up on the same side. Investigation disclosed that the pattern was bolted out of balance on the platen. Moving the pattern about 2 inches from its first position corrected the trouble.

Sand allowed to pack up on one side of the jolting anvil will do the same thing. A worn jolt guide will require a nicely balanced pattern to keep it jolting correctly. Holding the hands on the flask when jolting often is a help.

When the cope and drag flasks are jolted side by side, and one flask is appreciably heavier than the other, this trouble will be caused. Moving the flasks over sidewise until they balance, will correct this condition. If it is thought that the jolting is in any way at fault, ram a mold by

hand, and see if this relieves the trouble. If not, it must be upon the other side of the machine. If the vibrator is too weak, the mold will tear up, unless there is a great deal of draft. Try tapping the platen with a mallet when drawing the pattern.

If the mold *starts* a little, when the rock-over frame hits the stop, it will almost always cause a *tear up*. This generally can be remedied by tightening the jolt table close up to the key which locks the platen when the machine is rocked over.

If the pattern is drawn too fast there will be a *tear up*. In case of trouble the pattern should be thoroughly vibrated and then drawn as slowly and evenly as possible. A jerky motion often makes trouble. Oiling the ways and plunger generally will cure this.

If the mold starts down all right until the flask slips off the pins and then *jigs over*, the guides are worn and should be adjusted or renewed. A set of long pins will afford temporary relief.

Sometimes when the guides are worn and the pattern is slightly out of balance, it is only necessary to pull the pattern one way when drawing, to secure temporary relief. Sometimes a worn guide causes the mold to draw down sidewise in a direction in which there may be no adjustment on the machine.

A shim under one end of the pattern plate will remedy this. A pattern plated out of parallel will cause the same trouble.

If the mold appears to draw down out of square, this should be tested with a carpenters steel square, held upon the platen of the machine. Slowly draw the mold and watch the flask pass down along the blade of the square.

If the machine draws out of square in a crosswise direction, the stops may be adjusted. If in the other direction the pattern plate may be shimmed.

Often the trouble is caused by the adjustment of the automatic leveling device. Operators usually are inclined to set these too high. When they are raised, they not only are raised to the limit of their automatic adjustment, but a little more. This nearly always will tip up the mold, and make it start down with a little jerk. The leveling device should not be raised so high that it raises the position of the mold in the least. It is only necessary that the equalizing parts all touch the bottom board, before they are locked. If one of the equalizer parts becomes inoperative from any cause it will cause trouble.

After the operator adjusts the height of the equalizer if he forgets to tighten down the locknut, the table will be left in a tottering condition, which probably will be troublesome. Likewise if he forgets to lock the equalizer before he draws the mold, or if he forgets to unlock it before it is raised to the next one, there will be trouble. In case of unknown trouble always examine the equalizers carefully.

Often the bottom board is not of the right thickness or cleated correctly to fit the equalizer, when the operator places another piece of timber on the platen. This additional timber probably is not straight, or if it is, it may rock on the worn bottom board, so that while the equalizer may fit the additional timber, there will yet be a rock between this timber and the bottom board. Try well fitted bottom board. If the clamping device is not adjusted, so that the board is clamped over on one edge, trouble may arise from it.

An iron pattern plate may become peened out of straight by the operator pounding it with a hard hammer. When the pattern and machine have been working nicely, trouble may be due to sand that is too dry, or too weak. The riddle may be too coarse or the pattern may be too cold in winter. A good molder should notice and prevent these conditions, yet they are quite common causes of trouble.

In any case the patternmaker should not leave the molder in his trouble just because he knows his pattern is not at fault. The molder's troubles are great enough at best, and he appreciates a disposition on the part of the patternmaker to make his pattern as convenient to mold as he can, and in any other possible way to help the molder to get good castings, with a minimum of scrap and labor.

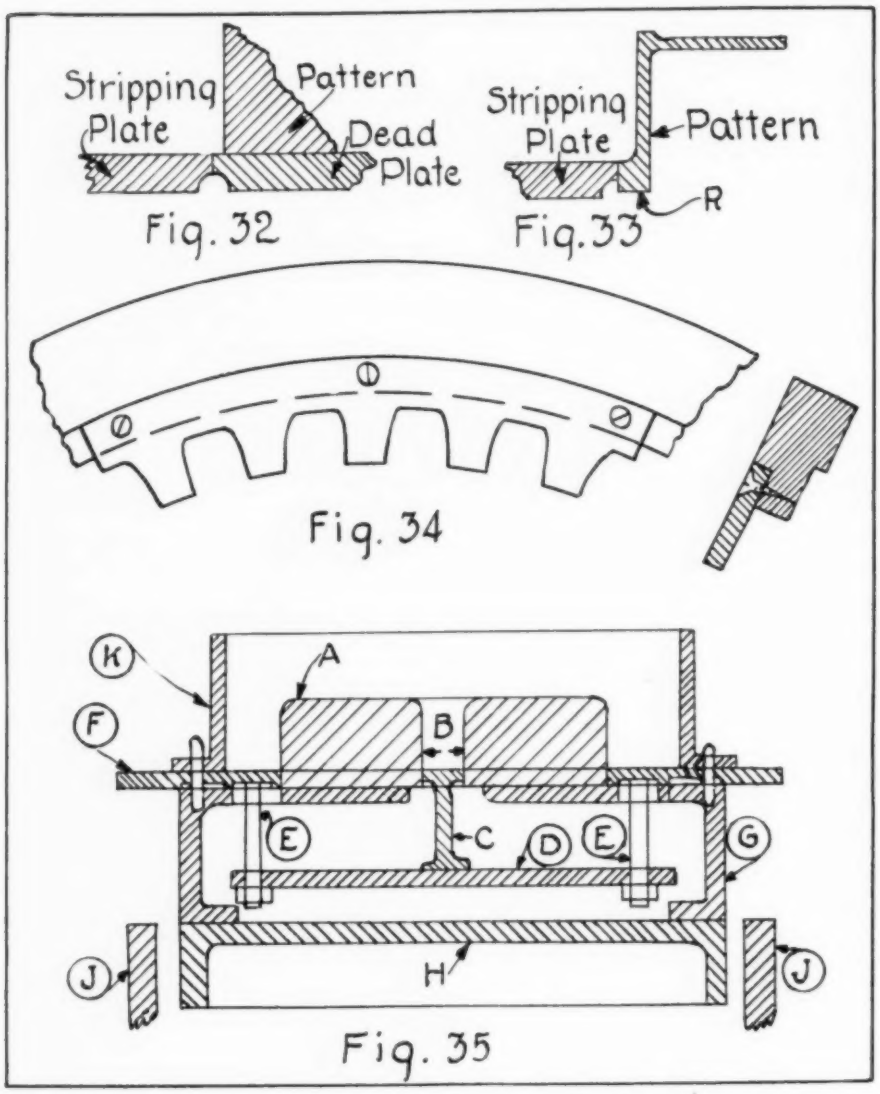


FIG. 32—THE STRIPPING PLATE IS KEPT BACK FROM THE PATTERN. FIG. 33—THE PATTERN IS STRIPPED FROM THE TOP OF THE BEAD. FIG. 34—SEGMENT STRIPPING PLATE. FIG. 35—METHOD OF ATTACHING STOOLING DEVICE TO A JOLT STRIPPER

Describes Handy Type Curbing

Light, Strong Steel Sheets Easily Assembled or Knocked Down Are Contrasted with the Unreliable, Cumbersome Cast Iron Sections That Still Remain as Relics in Many Foundries

By James A. Murphy

WHY do many foundries hoard examples of tradition and tragedy by keeping obsolete equipment, for example old flasks that even in their original state reflected little credit on their designers? This species of bogus economy is particularly prevalent in jobbing foundries and may be noted readily by any person who visits several plants in succession.

Recently I dropped into a shop with which I was familiar about 20 years ago and the first thing I noticed was the cast iron curb equipment. This curbing was considered ancient 20 years ago. In fact it was used for the first time in Civil War days. Stiil, here it was in all its pitiful impotence and the patterns were used occasionally to make a section or two, either for extension or to replace a broken member. The dismal, dirty, woe begone appearance of the place was in keeping with the equipment and through association of ideas brought to mind lines from *The Haunted House* that I had not seen since I was a boy going to school:

O'er all there hung a shadow and a fear;
A sense of mystery the spirit daunted
And said as plain as whisper in the ear,
The place is haunted!

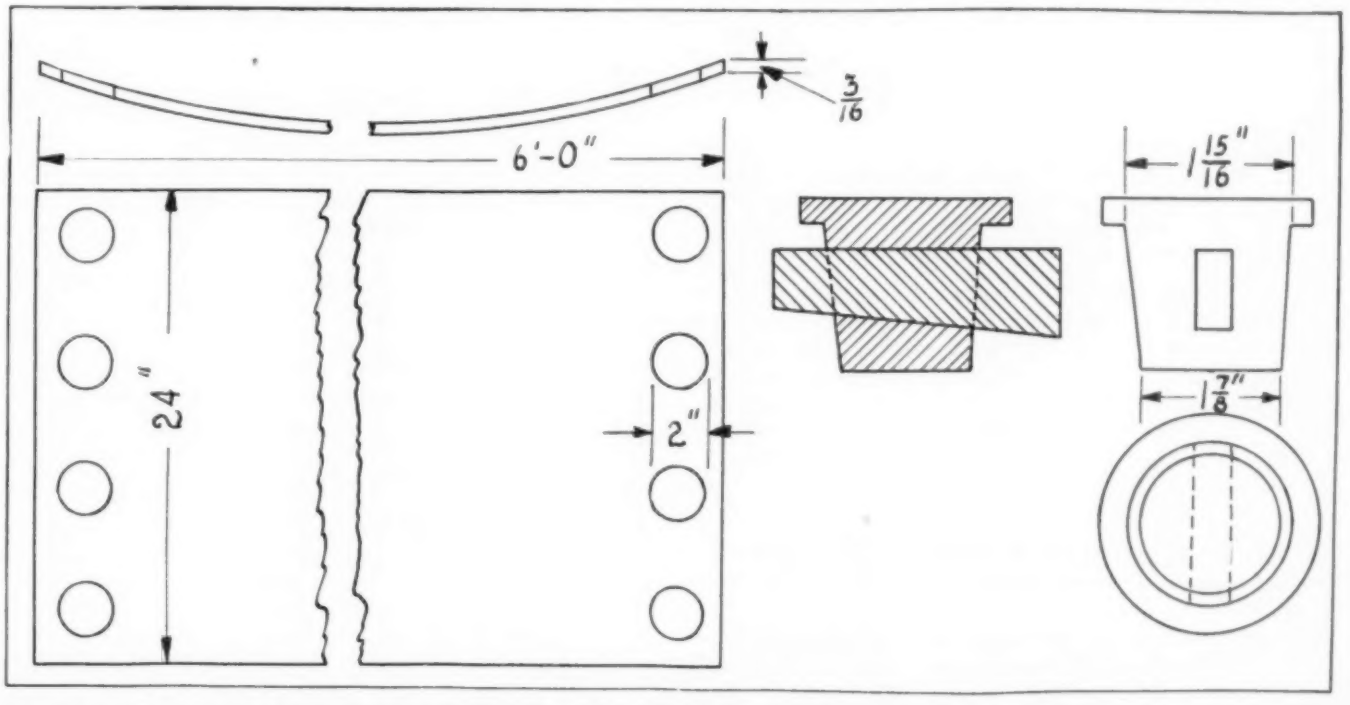
Each curb section had two cored lugs at each end through which a long pin was dropped to hold adjacent sections together after the manner of a pair of hinges. This type of curb never was good or safe. Assembling necessarily was slow due to the small size of the sections. Its only advantage was that it might be taken down more rapidly than some other forms in use.

Experience showed that one round of this curbing was not safe. Usually a second round was assembled especially on deep molds and in some instances sand was rammed in the pit outside the second round for further safety.

Without including the number of castings lost or damaged through the use of this ancient curbing, enough time has been lost, sometimes on one mold, to pay for a good steel curb. When I directed the foreman's attention to the subject he told me his firm drew the line closely on equipment expense. If he were to requisition the new fangled device I outlined he would be regarded suspiciously as an expensive person with no proper regard for the company's financial interests. He made satisfactory castings with the present equipment and the possible chance of making better profits with a change of equipment did not appeal to him.

In the hope of being of assistance to others similarly situated, also with a desire to contribute to the welfare of the foundry art as a whole, I am presenting the accompanying illustration and description of a cheap, serviceable steel curbing that has been in use for 20 years without a failure and is as good as ever yet. Castings of over 100 tons have been made inside this curbing above the floor line.

Steel plate curbing is in fairly common use, but usually it is held together with bolts and these constitute a nuisance. The danger of shearing



THE CURBING IS MADE UP 3/16-INCH STEEL PLATE 2 X 6 FEET HELD TOGETHER BY CAST IRON PLUGS AND WEDGES INSTEAD OF BOLTS

small bolts always is imminent, but the principal objection to the use of bolts is that the sand must be removed from inside the plate to make room for a wrench on the head of the bolt while the nut is being removed from the outside.

Cast iron plugs and wedges are employed for assembling the curbing shown in the illustration. If they are molded carefully they require no more than a tumbling mill finish. The holes in the plate are drilled instead of punched and are laid out in such a manner that the holes in all plates coincide. The sheets may be any thickness, but 3/16-inch is thick enough for the heaviest class of work and plates of this thickness will withstand rough handling better than plates of a lighter gage.

After the curbing has served its purpose the wedges are knocked out and the plugs are driven back into the sand. The plates are stored away in nested formation until they are required again. They occupy little space and the plugs easily are recovered from the sand. The rig is rough, strong and thoroughly serviceable as has been proved over a number of years. The main sheets are 2 x 6 feet and may be bent to any radius. With one or two short lengths, 2 or 4 feet, practically any size circle may be enclosed.

Joseph M. Corson, W. I. Overstreet and E. H. Owen have established a brass and aluminum foundry at 216 Columbia street, Portsmouth, Va.

Cast Steel Jaws on Small Vise

Question: I have been trying for some time to cast small vises in which the jaws are to be formed by steel plates. Up to the present I have not succeeded. I shall appreciate any information on how this kind of work is done.

Answer: Information on how the job is done is simple enough, but unless the work is carried on with the greatest attention to detail it will not be successful. Briefly, the steel jaws are tinned before they are placed in the mold. The mold is gated in a manner that will cause a stream of iron to flow over the plate and a small quantity is flowed through a riser to note whether or not it is lying quietly in the mold. The local tin smithing establishment is the most logical place in which to have the plates prepared, but if one of these places is not available you can tin the plates yourself with little trouble by dipping them in a pot of molten tin.

They must be cleaned perfectly before they are dipped or the tin will not adhere to them. If the plates merely are slightly oxidized they are cleaned by dipping them first in a pickle bath, then rinsed in hot water and then almost instantly afterward when they are dried they are dipped in the molten tin. If the plates are prepared in the boiler shop or the machine shop they will come into the foundry either partly or wholly covered with grease. This coating must be removed by a caustic solution before the plate is dipped. The plates are slightly warmed before they are placed in the mold to prevent any condensation of moisture on the surface.

Book Review

Engineering Index 1925, published by the American Society of Mechanical Engineers, New York, 808 pages, cloth, 9¼ x 6½ inches. Supplied by THE FOUNDRY, Cleveland, for $7.00, net.

Few men have the memory of that famous if mythical character from the advertising pages, who recognizing Addison Sims of Seattle, recalled the conversation at their previous meeting four years before. Engineers, scientists and other professional men wish to refer to articles that have been published in trade and technical magazines and papers at some past period, and often they find that they have mislaid the reference or forgotten the publication in which it appeared. These men and others who have occasion to consult a bibliography on engineering equipment, materials, etc., will find the 1925 edition of the *Engineering Index* of considerable value. All articles that have appeared in the leading trade and technical magazines and papers, both domestic and foreign, are listed under main headings and subdivisions with the name of the publication. A short abstract of each article also is given.

Thirty Years Late!

SPEED hangs up records for salesmen in this day of flivver dodging when everybody is trying to keep two jumps ahead of the procession. Speed may pay—but—hurrying caused one young man to better Rip Van Winkle by ten years. You see it was like this:

Some time ago THE FOUNDRY started a department in each first of the month issue giving salient features of foundry interest taken from the pages of this publication 30, 20 and 10 years ago. To be sure that the reader would understand that this material was hot news in the days when whiskers were worn, the Editor headed the page in Bold Black type with the following:

Milestones in Foundry Progress

As Recorded in the June Issues of THE FOUNDRY Thirty, Twenty and Ten Years Ago

In the June 1, 1926 issue the following item appeared under a heading indicating the days of Grover Cleveland, as shown in the upper right hand corner:

1896

GROVER CLEVELAND

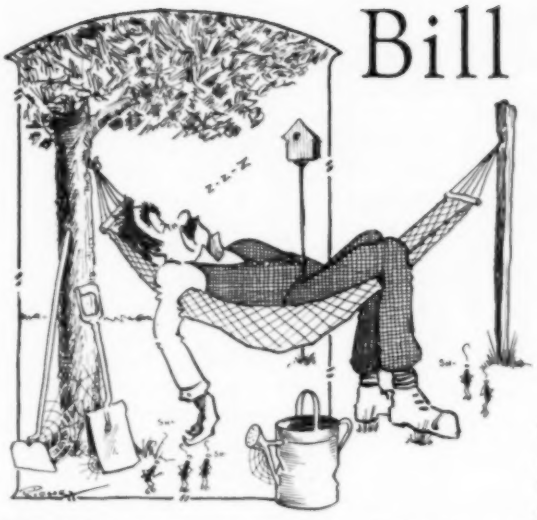
The Falcon Bronze Co., Youngstown, O., was working on a large order from the Great Western Tin Plate Co., Joliet, Ill.

A result of the publication of this item is told in the following letter from the Falcon company:

A representative of a large concern dropped in here the other day, soliciting business. We were interested to know what prompted his call. He said: "I see in THE FOUNDRY that you recently secured a large order."

The writer, of course, was curious to know what your publication would have to say about any business we might have on our books. This news item was passed over to the writer and it gave him great pleasure to put a circle around the date. We all had a good laugh over it.

Salesman's response not appended, but doubtless he pulled a fast one like, "So's your old man."



Bill Talks on Gardens *and* Core Binders

By Pat Dwyer

EVERY year as the rays of the sun begin to make themselves felt in the spring, faint flutterings of a primordial instinct urge me to make a garden. Day by day as the sun steadily climbs higher, the resolve becomes stronger to start the work on the first fine Saturday afternoon. I gaze longingly out the window in the day time and reflect bitterly on the harsh and cruel fate which keeps me cooped up like a squirrel in a cage while my more fortunate fellow citizens are digging up the odorous surface of the earth and inhaling the life giving ozone and the aroma from a bag of guano.

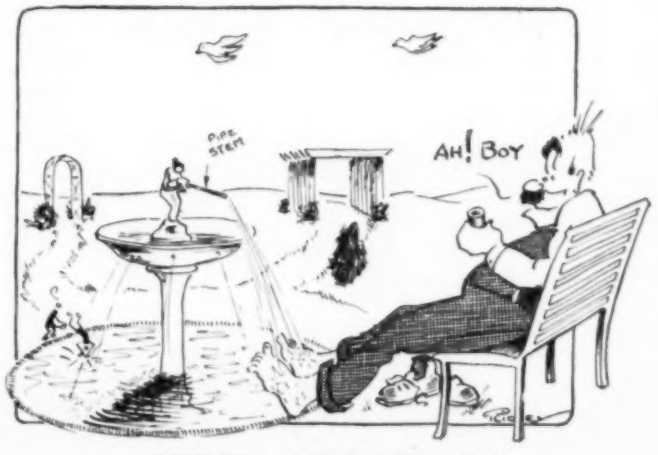
In the evening I sit luxuriously before an open fire and in the dancing flames I see the garden as it will appear in a riot of glory and bloom later in the summer. Stately hollyhocks flaunt their barbaric beauty and glance down condescendingly on their more modest sisters, tulips, poppies, sweet williams and carnations arranged in geometrical patterns within a setting of emerald turf. Climbing roses cover a trellis on the sunny side of the house and fill the air with a languorous perfume that almost causes the indefatigable honey bees to forget their Spartan instinct and lie down on the job. Scarlet and yellow nasturtiums line the white gravel paths while a lordly geranium lifts its clusters of deep red blossoms from a mass of green resting in a huge brass jardiniere at every point where the paths intersect each other. The hideous back fence is covered with a dense growth of sweet peas fit to line the lane that leads to paradise with leaves as bright as the emerald sea, blossoms, white, pink, blue and purple, soft and smooth as the inside of a pearl shell and pure as the heart of an innocent child. A luxuriant Virginia creeper conceals the walls of the garage and furnishes a home for a pair of little adventurous yellow birds.

Sometimes in my more expansive and ambitious moments I decide on either a sun dial or a fountain for the center piece in the garden. I fully realize that the erection of either one will entail a considerable amount of hard work, but that is only a trifling detail to be considered when the proper time arrives. The sun dial shall be mounted on a massive granite bowlder left in its natural and rugged simplicity with the exception of an area on the top which I shall hew to a true plane and polish before I affix the jigger, the doodad, the hickey or whatever the proper title is for the dingus which marks the hours. Up to the present I have no clear conception of how one goes about securing a suitable bowlder either new or second hand, but I see no necessity of crossing that bridge until I came to it.

Of the two ornaments I lean more strongly toward the fountain, a pure white marble basin with a pedestal in the center supporting a graceful bronze nymph balancing a water jar on one shoulder. The water will gush up through a grating in the mouth of the jar and envelop the figure in a shower of feathery spray in its descent. I can conceive of nothing more soothing on a hot blistery day in August than to sit in the shade of a giant oak tree smoking a pipe full of five brothers tobacco and watching this spray shot through with all the tints of the rainbow, gently descending cool and refreshing over the bronze maiden.

Times without number I have seen myself manfully swinging a pick and shovel excavating for this work of art. I have laid the concrete foundation, connected the necessary piping, cemented the marble blocks in place erected the pedestal and bronze figure and turned on the water. The hard work, the backache, the blistered palms all have been forgotten in the glory of achievement. A little exercise of the good old will power was all that was necessary.

Unfortunately, something always has prevented me from putting my plans in execution. Without mentioning any names a certain person who attends the flowers inside and outside the house flatly states that nothing but sheer inborn laziness prevents me from making a garden. Brazen statements of this kind cause me the most poignant distress. On more than one occasion I have besought her to listen to reason. With a perfectly open and unbiased mind I have offered to discuss the question strictly on its merits pro and con, but invariably she has replied flippantly that my arguments are all con and besides she is too busy. Thank goodness she has said on more than one occasion at least one member of the family has sufficient pride to try to make the place at least half way respectable. This confession is not presented as an excuse for my failure to make a garden according to my carefully prepared plan. Neither is it intended to detract from the credit due the lady actually responsible for the garden as it exists today. True, many of the features I had



LOVE WILL ALWAYS FIND A WAY

in mind have not been adopted even though I magnanimously suggested them for her approval, but on the other hand as you might say, I have held myself in readiness at all times to contribute either moral support or material assistance.

Am I to blame if I was not requested to supply either one or the other?

Although ready and willing at all times to co-operate to the best of my ability I am not one to push myself needlessly forward and have all the work pushed off on me. In other words why should I be the goat? Take that one home Thaddeus and try it on your jewsharp. On the first Saturday after the official garden season opened I came home at noon fully determined to do all the preliminary work and thus get away to a flying start. Unfortunately, in looking over the paper I noted that the weather man predicted rain for the afternoon and in my capacity as official provider for the family I did not feel justified in venturing outside where I probably should contract pneumonia or rheumatism. The weather man was wrong as usual, the sun shone brightly all day, but that fact does not reflect on the soundness of my judgment in adopting proper precautions. The afternoon was not wholly wasted. I spent the greater part of half an hour drawing a sketch of the proposed garden and in compiling a list of the required materials and then reveled for the remainder of the afternoon in a book of South Sea tales where the most gorgeous and luxuriant vegetation flourishes spontaneously.

On the following Saturday afternoon I discovered to my surprise that the preliminary work was well under way and I discreetly refrained from interfering. I dislike exceedingly to have others come blundering in on me after I have started a job and I am not one to do to others what I hate to have others do to me. Kindness and consideration ever have been my watch word. I decided to let nature take its course, at least for the present season.

Bill came over the other night and commented admiringly on the apparance of the various flowers and shrubs. Fortunately we were alone on the veranda and I admitted modestly that gardening was my favorite hobby. In addition to being a recreation it afforded me an opportunity of spending a considerable time in the open air and without doubt contributed to my perfect physical condition.

"Well" said Bill, "I'll tell you. Knowing your fondness for the open air and physical exercise I think you are a first cousin to Ananias. My own private opinion is that you had as much to do with making this garden as you had with building the pyramids of Egypt. I suppose it is all a matter of personal inclination with perhaps a dash of early training and environment. I was over to a lad's house the other night where I saw an inspiring example of amateur gardening.

Gardening is reduced to a scientific basis

"This gallant young lad is the impersonation of propriety and accuracy who always looks as if he just had stepped out of a bandbox. He has a suit for every occasion including a complete garden outfit with gloves. He spaded the ground carefully and reduced every lump to a size that would pass readily through a No. 4 riddle. To insure symmetry, order and exactitude in the appearance of the onions, beets, cabbages and beans he decided to plant them at a uniform distance apart fore and aft and from side to side. To that end he measured the plot carefully and prepared a working drawing 1 inch to the foot. After several attempts with a slide rule and a pair of dividers he discovered that the plants might be spaced on 18-inch centers both ways to completely fill the plot of land.

"Instead of verifying his calculations by marking the spaces and trying them with a line he proceeded blithely to start at one side. He pegged the line at both ends exactly 18 inches from the side and dropped the seeds 18 inches apart. Then he shifted the line 18 inches and continued in like manner until he approached the farther side. To his dismay he found what many a molder has found in working with a gear segment or other form of segmental pattern in which projecting members must occupy arbitrary positions. The line had *crept* a little each time and the final space was only 12 inches instead of 18. The ordinary citizen either would have accepted the situation philosophically or cursed the perversity of inanimate objects and let it go at that. Our hero is not an ordinary citizen. He checked and rechecked the distances to prove that his original calculations were correct and then dug up every seed in the garden and replanted them. You may claim that is an extreme instance, but I sometimes wonder whether amateur gardening of any kind is worth the trouble. Leaving aside the problematical pleasure the whole thing simmers down to a question of costs and after all that is the deciding factor in nearly every activity. I had a letter the other day from a foundryman in a foreign country who said he had to import core binder and parting material. The freight and duty added considerably to the expense and he wanted to know if I could give him the formula for a good core binder and parting that he could prepare locally.

"In my reply I pointed out that a long list of materials is available for core binders, but without a knowledge of the sand and the character of the cores in use it is impossible to specify the best binder. In the last analysis the cost is the determining factor and I am not familiar with the prices of commodities in his district. Also I do not know if the entire list of possible materials may be secured there. Proprietary core binders manufactured in this country have been developed to a high state of perfection and invariably yield satisfactory results when employed intelligently. Obviously, the formulas and methods of preparation are closely guarded.

"Any material that will cement the sand grains may be used as a binder, but certain materials are more suitable than others under different conditions. For example, clay manure or flour may be used with perfect safety on large cores containing a con-

siderable quantity of molding sand, but are not at all suitable for small and intricate cores made exclusively from sharp sand and almost entirely surrounded with metal.

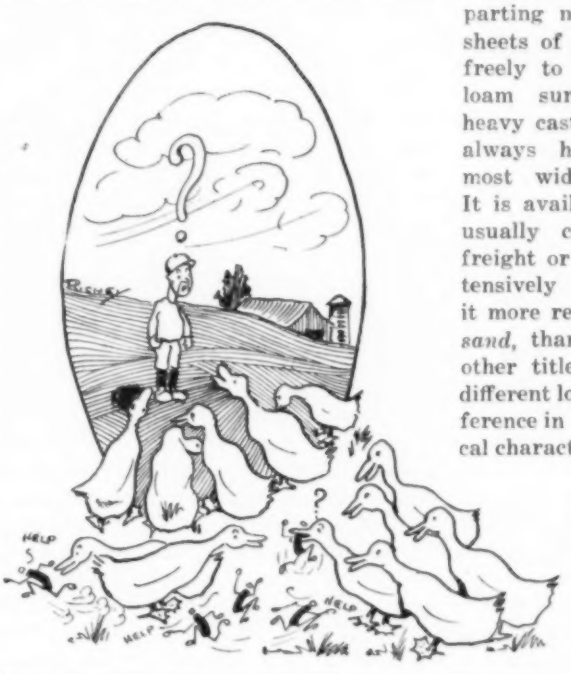
"Core binders are divided into three main classes. Dry binders prepared in the form of a powder and mixed with the sand in that state. Water soluble binders prepared either as dry or liquid and diluted with water before they are added to the sand. Oil binders which are added to the sand in a natural state or in combination with other materials designed to reduce the cost.

"The first class includes flour, rosin, pitch, pease meal and by-products incidental to flour milling operation. The second class includes glue, starch, sugar, molasses and waste liquor from pulp and paper factories. The third class includes practically all the oils of which linseed oil, crude oil and fish oil are the most extensively used in the order indicated.

"At one time flour was used almost exclusively and it still is used extensively particularly in jobbing shops where a wide variety of cores are made. It is mixed with sharp sand in the proportion of 1 to 10 and in lower proportions where molding sand containing more or less clay supplies part of the necessary bond. The principal objection to flour is that it has a tendency to swell the cores and the smoke from the vents is exceedingly irritating to the eyes and lungs. Ground rosin is a satisfactory binder particularly for small plain cores. It is only effective when the cores are dried and cold. In the green state and later while the cores are hot, the cores are weak and must be handled carefully to prevent collapse or distortion.

"Ground pitch forms the base of several black compound binders and is used in varying proportions depending on the shape and size of the core. If used to excess or if the core is not thoroughly burned this material carbonizes and unites with the sand in a hard mass that is difficult to clean out of the casting. It is used extensively and where proper precautions are observed no trouble is experienced. Pease meal and flour mill by-products are used in the same manner and yield the same results as flour. The price usually is lower than the price of flour. However, in many instances it is possible to buy at a low price damaged flour unfit for human consumption but perfectly satisfactory for core making purposes.

"Glue water is an excellent core binder and is preferred over any other by many foundrymen who have been accustomed to its use. The only objection is that if the cores are left over night in green sand molds they will *draw dampness* and become soft. The glue is boiled in water to reduce it to a liquid and then is diluted further with cold water before it is added to the sand. Molasses or syrup diluted with water serves as a fair core binder in core sand mixtures containing clay that has been added in the natural state or as one of the ingredients in molding sand.



YES! THIS IS THE PLACE "WITH A DUCK-DUCK HERE," ETC.

"Pure linseed oil is the best and strongest of all the binders bulk for bulk, but it also is the most expensive if measured on the same basis. However, the price alone is no criterion. For example if one gallon of linseed oil at 80 cents a gallon will bind as great a quantity of sand as 5 gallons of another binder at 16 cents a gallon, it is apparent that one costs just as much and no more than the other. Furthermore, and this is a point that applies to all binders, the smaller the amount used the better. Some form of binding agent is required to hold the sand grains together, but every particle of binder between the grains lessens the porosity of the sand to that extent. The ideal core is one in which the structure offers the least resistance to the passage of the gas. The binder is the material from which the gas is generated, therefore, good practice holds the amount to a minimum. Under favorable circumstances linseed oil will bind sand in the proportion of 1 part of oil to 100 parts sand, but the average all around ratio is 1 part oil to 55 parts any kind of sharp sand.

"Fish oil and crude oil make satisfactory core binders, but as stated previously their use hinges to a great extent on their availability and their price compared with other materials suitable for core binders.

"Artificial parting compounds are based principally either on a vegetable material know as lycopodium or on a mineral known as tripoli. Pulverized charcoal is used to some extent as a parting medium on light work while sheets of paper and oil are used quite freely to separate adjoining sand or loam surfaces in foundries where heavy castings are made. Sharp sand always has been and still is the most widely used parting medium. It is available nearly every place and usually costs little more than the freight or truckage. It is used so extensively that foundrymen recognize it more readily under the title *parting sand*, than they do under any of the other titles by which it is known in different localities. With only slight difference in either composition or physical characteristics the sand is designated silica sand, fire sand, sea sand, beach sand, sharp sand, river sand, silver sand, and building sand. This kind of sand is made up of individual grains without any binding material to hold them together. Usually it is pure white, but some deposits are gray or tinged slightly with yellow. It is sprinkled in a dry state over horizontal or nearly horizontal surfaces. Slightly dampened with water it may be applied to parting surfaces approaching the perpendicular."

"Forget the foundry for a while," I said "and let's get back to the original subject. Did you ever do any gardening?"

"Who," says Bill, "Me? I get all the digging I want in the foundry. I know as much about rural life as the young lad the farmer sent to feed the ducks. He threw them a few forkfulls of hay. When he returned from the mission the farmer asked him if the waddlers had eaten all the food. 'Search me' says the lad. 'They were still talking it over among themselves when I left'!"

Method of Making Cope and Drag Plates

Question: When making cope and drag machine pattern plates, is it necessary to use two flasks and interchange the cope of one with the drag of the other. What reason is

there for this? It seems to me that the cope part might be made in one flask and the drag part in another without any interchange of the two. If there is a reason I should like to know what it is.

Answer: Several methods are available for making pattern plates and if you have access to back numbers of THE FOUNDRY we suggest you look over a series of articles on the subject that appeared consecutively from Feb. 1 to May 1, 1922. In the method to which you refer two flasks are used and the interchange of cope and drag are made to facilitate operation and save time. In other words the second flask simply consists of a pair of *flatbacks* and naturally the cope half has to be used with the drag half of the flask containing one part of the pattern plate, while the drag half has to be used on the cope half of the flask containing the other half of the pattern plate.

The method is applicable to a single split pattern or to a number of small patterns designed to be poured in the one flask. For purpose of illustration we assume that a single pattern is used. The mold is made in the usual manner in a master flask large enough to provide room for a border of sand at least 1 inch wide outside the proposed size of the plate. The two halves of the mold are placed face up on a level bed and then each is treated as a drag. A rectangular wood frame the size of the proposed pattern plate is located on the drag. This frame may be ¼-inch, ⅜ or even thicker, depending on conditions. Wood strips of equal thickness are laid on the joint of the flask and the space between the frame and the strips is packed full of sand and scraped off flush. The frame and the strips then are removed and placed in corresponding positions on the second half of the mold where a similar wall of sand is built to form the plate thickness. The frame then is removed but the strips on the joint are left in place to hold the sand and also to support the weight of the cope. The greatest care is required in setting the frame on the second half of the mold to insure a *match* when half molds made from the two plates are assembled later.

The copes for the two molds are made in the cope and drag of a second flask. They may be rammed separately directly on the joint of the mold, on a flat board, or the first part may be rammed on a board, rolled over and used as an ordinary drag on which the flat cope may be rammed. In either case you will note that on account of the guides, the drag half of the second flask will only fit the cope half of the first flask and for the same reason the cope half of the second flask only can be placed on the drag half of the first flask.

The foregoing refers to plates with flat backs. Where the back of the plate has to be hollowed out to conform in a general way with the shape of the pattern, the procedure is slightly different. The mold is made as in the first instance and both halves are placed face up on a level bed. The half patterns are removed and the face of the mold, also the flat joint surface is covered either with paper or parting sand. Two halves of a second flask then are adjusted in place, the cope of the second on the drag of the first and the drag of the first on the cope of the second. They are rammed full of sand and removed. The original cope and drag then are shaken out and made over again. They are placed face up on a level bed where the patterns are removed and the thickness for the plate built up as described previously. The second cope and drag are returned to their appointed places and the plates are poured. In some cases it is necessary to shave the side walls on the cope impression to secure the proper thickness.

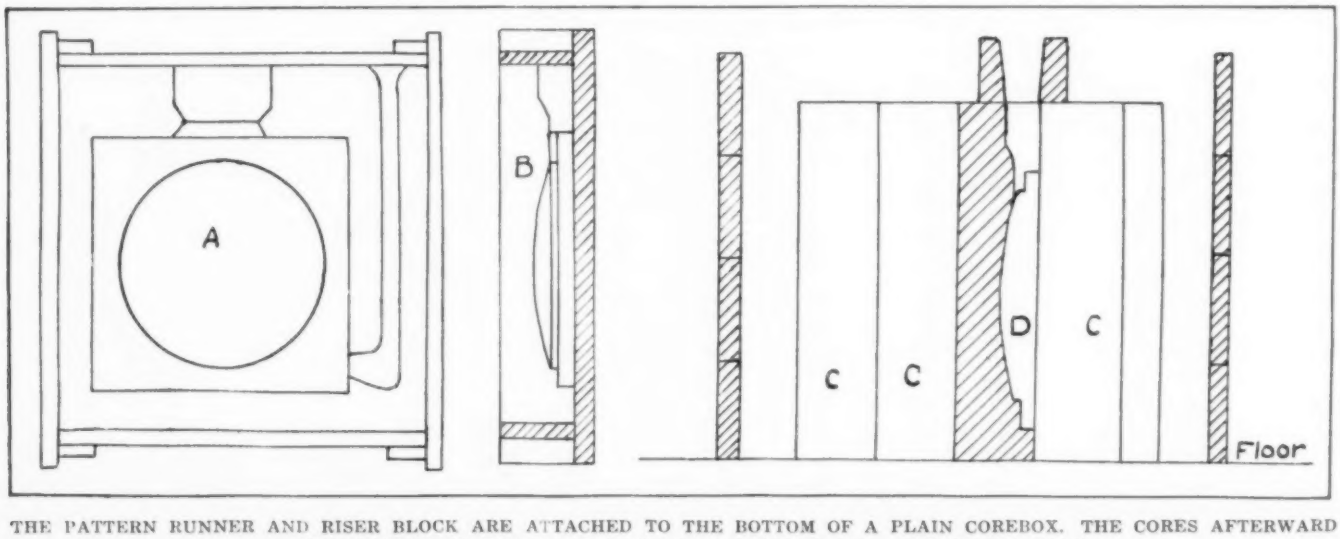
Steel Disk Is Cast on Edge

By William Pink

An improved method for casting steel disks and similar shaped castings is shown in the accompanying illustration. *A* and *B* respectively show a plan view and sectional elevation of a plain square corebox with the pattern of the disk attached to the bottom. The runner and the riser block also are attached permanently to the same foundation. Since the back of the disk is flat it is apparent that each core made in this box will form the drag half of one mold and the cope half of the adjoining mold. The fact that the cores are assembled on edge instead of flat does not affect their relationship to each other. Briefly, the cores are assembled horizontally instead of vertically.

In the figure on the extreme right four cores are shown assembled inside a number of flasks where later the space between the cores and the flask is rammed full of sand. Other methods of course also are available for holding the cores in position. One core *D* is shown in section. In the illustration an individual runner is shown for each mold. This is optional. If necessary the runner may be arranged to pour several molds at the same time.

Delbert C. Davis and Charles L. Kenyon have been made assistant treasurers of the General Electric Co., Schenectady, N. Y.



THE PATTERN RUNNER AND RISER BLOCK ARE ATTACHED TO THE BOTTOM OF A PLAIN COREBOX. THE CORES AFTERWARD ARE ASSEMBLED INSIDE OF A FLASK OR FRAME AND POURED ON EDGE

Milestones in Foundry Progress

As Recorded in the July Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago

1896

GROVER CLEVELAND

HENRY HANSEN, subsequently editor of THE FOUNDRY, contributed the second of a series of articles on the manufacture of radiators, published in the July, 1896 issue. In those days a molder and a helper rammed and placed 36 half flasks in an hour. They peened them around the edges and then completed the ramming with their FEET.

* * *

Perhaps that deathless old hymn of Civil war days had its origin in the style of ramming which still is encountered in some brass foundries. In that case the song probably started, "Tramp! Tramp! Tramp! The Boys Are Molding."

* * *

Thomas D. West advocated the center blast for cupolas, explaining that the scoring of the lining near the tuyeres was due to the entering blast turning sharply upward, instead of the force of the blast reaching across the bed to the opposite side.

* * *

His plan, involving a central pipe with a mushroom cover, never was commercially successful. One reason was the destruction of the pipe by the weight of the descending charge breaking off the deflecting head to the blast pipe.

* * *

Agitation over the money standard, then the national political issue was disturbing business. *The Scrap Heap*, a department of that period, deprecated this tendency to become hysterical since nothing radical could result which ever party won the election.

* * *

RUTHLESS RHYMES

Steven Demagogue was his name,
A man of long and limber tongue.
He stormed and ranted—hurled the blame.
* * *
Now bells in solemn time are rung!
"What caused this mighty man to die?
What hastened his untimely fall?"
The answer came with whispered sight,
"Steve's party lost. He burst his gall."

A. V.

* * *

High tribute was paid to Francis Shumann, re-elected president of the American Foundrymen's association and to Howard Evans, again chosen treasurer of the organization. The latter, who still is secretary of the Philadelphia Foundrymen's association, was credited with being the father of the American Foundrymen's association idea.

* * *

The ten great foundry centers of the country with their number of shops were as follows: Chicago, 90; Philadelphia, 76; Brooklyn, 57; Pittsburgh, 56; Buffalo, 42; New York, 34; Cleveland, 33; St. Louis, 31; Detroit, 27 and Cincinnati, 26.

Faked Foundry Facts

A Long Floor

1906

THEODORE ROOSEVELT

JULY, 1906 was the American Foundrymen's association convention issue of THE FOUNDRY. The gathering, which was held in Cleveland, was the eleventh annual convention of that organization. David Reed was president and the membership reached a total of 334. N. S. Calhoun, Johnson & Jennings Co., Cleveland, welcomed the visitors.

* * *

Liquid refreshments poured from a cupola set up for the smoker at the Central Armory, were delivered to waiting steins from hand ladles.

W. H. McFadden, donor of the McFadden medal in later years, was elected president and a number of district vice presidents were chosen.

* * *

Prof. H. Ries, Cornell University, Ithaca, N. Y., contributed a valuable paper on the laboratory examination of molding sand.

* * *

It was stated editorially, " * * the convention made it evident that the foundry of the future is to use machinery and use it extensively."*

* * *

The Warren Foundry & Machine Co., Phillipsburg, N. J., celebrated its fiftieth anniversary on June 7, 1906.

* * *

The Springfield Foundry Co., Springfield, Mass., was constructing a new shop.

* * *

The Dickson Car Wheel Co., Houston, Tex. was building a new shop on the site of one just destroyed by fire.

1916

WOODROW WILSON

ALLYNE-RYAN FOUNDRY CO., Cleveland, one of the pioneers in the production of automotive castings occupied the leading position in the July, 1916, issue of THE FOUNDRY, through a complete description of cylinder casting methods.

* * *

Joseph H. Horner gave a complete illustrated description of the methods and equipment employed in molding a diesel engine cylinder.

* * *

The era of new construction to meet wartime demand was just commencing. Extensions and revisions of existing structures were the order of the day.

* * *

The Stowell Mfg. & Foundry Co., South Milwaukee, Wis. was reorganized and R. A. Nourse was made vice president and general manager.

The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor

CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶ What Will Be Next

GROWTH and development of American industry during the past century may be attributed directly to the invention and application of many mechanical devices, which gradually have become indispensable in the lives of all people. Each new device that relieves the drudgery of labor, eases the work of the housewife, or adds to the pleasures of mankind, also brings new members to the great body of the country's industry, and makes new demands on existing establishments.

The foundry industry has been benefited greatly by progress in this mechanical age, not only in methods of practice, but also in total output. Of course, the greatest boon to the foundry field has come through the tremendous strides made in the automotive industry, which continually demanded a better product, produced more cheaply and in larger quantities. Foundries have contributed directly to the high totals of automobile output. Other industries, which have forged ahead in the march of progress, also have found the foundry indispensable. In this class may be included the electrical industry, railroads, and machinery manufacturers, such as textile, metalworking and woodworking.

INCREASING popularity of mechanical devices used in the home also has opended extensive market for foundries, and in some instances has placed requirements on the industry which have taxed the ingenuity of leaders in the field. The washing machine, ironing machine, vacuum sweeper, and the sewing machine all are selling in greater quantities each year, and thus creating a greater demand for castings.

The latest entrant into the field, of domestic machinery, the iceless refrigerator, also is requiring an increasing tonnage of castings each year. Not so long ago, refrigeration processes needed few castings, for the ice used was cut from lakes and rivers and stored in ice houses in winter, and was sold in summer. The ice was placed in refrigerators or chests, which required few castings in their construction. Today large tonnages of ice are manufactured in special machines, built almost entirely of cast parts. Under the new systems now widely advertised, the refrigerating chambers are cooled by iceless mechanical methods, which carry on automatically.

Future possibilities in the field may be realized when it is considered that although the estimated number of electric refrigerators in operation at the close of 1925 was 120,000, it is believed that the possible market of the industry is in the neighborhood of from 5,000,000 to 10,000,000 machines. The later figure is based on the number of ice refrigerators now in use and the number of homes wired with electricity in the country. Last year, 37,000,000 pounds of cast iron was used by the industry, while lesser amounts of nonferrous metals in the cast form were employed. It is believed that the value of raw materials used by this industry in 1925 will approximate $75,000,000.

¶ Ready To Serve

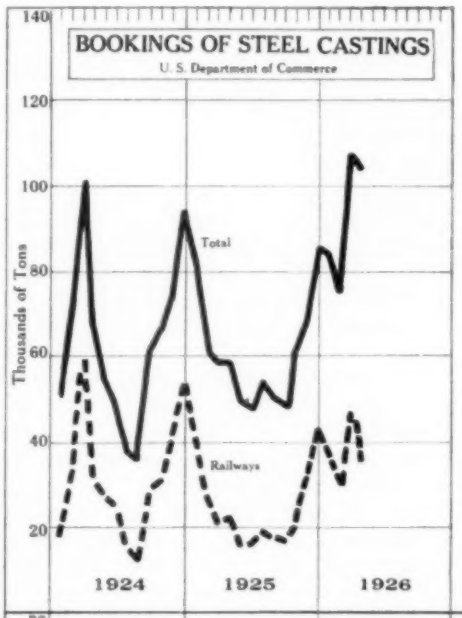
DURING the past 10 years, an American organization whose work impinges upon and influences to a vast degree every line of industry, has shown a remarkable growth. Its membership is confined to manufacturers and users of practically all materials known to modern engineering and manufacturing activity with, notably, a sprinkling of technical men who may be said fairly to represent the general public. In the period from 1916 to 1926, this organization, the American Society for Testing Materials, has extended its roster from slightly in excess of 2000 to more than 4000, according to the report of its executive committee offered at the twenty-ninth annual meeting in Atlantic City during the week of June 20. The usefulness of this society to the foundry industry is typified by the standards for gray iron, steel, malleable and nonferrous castings; in established methods for testing and grading the wide range of materials used in castings; and in its continued search for achievement in prolonging the service and extending the field of products cast from every variety of metal.

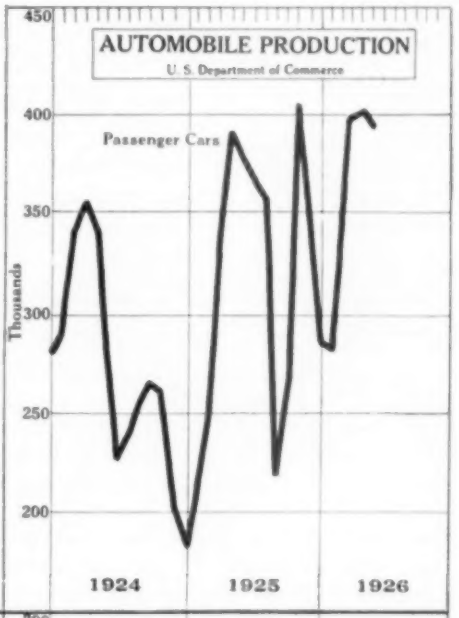
Trade Trends in Tabloid

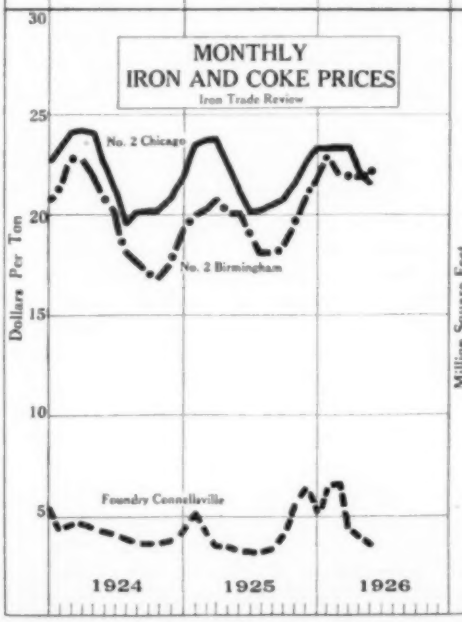
SLIGHT declines, noted recently in foundry operations in some sections of the country, are attributed to the seasonal slackening in many manufactured lines, especially in the automobile industry, and to the lack of substantial equipment buying by the railroads. While a few automobile manufacturers are increasing production, the tapering off by the remaining companies has been sufficient to lower the total output, as is evidenced in the report of the department of commerce. Although production of cars and trucks in May was 446,155, or 9687 less that in April, the output for the 30-day period was practically 16,000 in excess of the production in May, 1925. Orders for 124,479 bathtubs and 126,732 sinks were received in May, directly reflecting the extensive building construction which now is under way. The average melt in Ohio, as reported by the Ohio State Foundrymen's association, was 76.2 per cent of normal in May as compared with 86 per cent in April and 77.8 per cent in May a year ago. Stocks of materials received declined slightly, May indicating 68.9 per cent of normal and April about 72 per cent. Stocks on hand have declined to 95 per cent from 100 per cent in April, and nonferrous operations have declined to 57.2 per cent as compared with 68 per cent in April. Foundry activity in the northwest is high the work coming from logging, sawmill and cannery machinery.

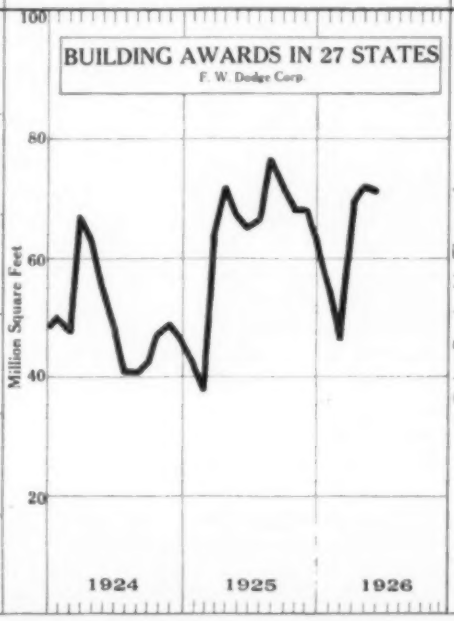
RAW MATERIAL PRICES
JUNE 22, 1926

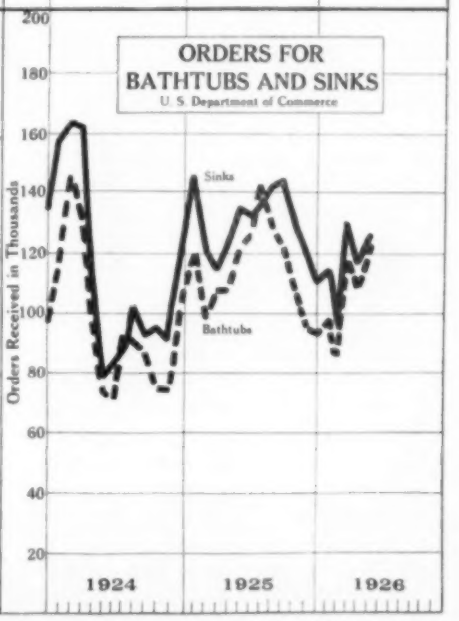
Iron	
No. 2 foundry, Valley	$18.00 to 18.50
No. 2 Southern Birmingham	21.00
No. 2 foundry, Chicago	21.00 to 21.50
No. 2 foundry, Philadelphia	22.26
No. 2 foundry, Buffalo	20.00
Basic, Valley	17.50 to 18.00
Basic, Buffalo	19.00
Malleable, Chicago	21.00 to 21.50
Malleable, Buffalo	20.00
Coke	
Connellsville foundry, coke	$4.00 to 4.50
Wise County foundry, coke	4.25 to 5.50
Scrap	
Heavy melting steel, Valley	$16.00 to 16.25
Heavy melting steel, Pitts	16.00 to 16.50
Heavy melting steel, Chicago	12.75 to 13.25
Stove plate, Chicago	13.25 to 13.75
No. 1 cast, New York	14.50 to 15.00
No. 1 cast, Chicago	16.50 to 17.00
No. 1 cast, Philadelphia	17.50 to 18.00
No. 1 cast, Pittsburgh	15.50 to 16.00
No. 1 cast, Birmingham	16.50 to 17.00
No. 1 cast, Buffalo	15.75 to 16.25
Car wheels, iron, Pittsburgh	16.50 to 17.00
Car wheel, iron, Chicago	15.50 to 16.00
Railroad malleable, Chicago	16.75 to 17.25
Agricultural, mall., Chicago	15.00 to 15.50
Malleable, Buffalo	16.50 to 17.00
Railroad Malleable, Pitts	16.00 to 16.50
Nonferrous Metals	Cents per pound
Casting copper, refinery	13.50
Electro copper, refinery	13.87½ to 13.95
Straits tin	60.12½
Lead, New York	8.25
Antimony, New York	13.00
Nickel, electro	39.00
Aluminum, No. 12 prod'rs	26.50
Aluminum, No. 12, remelt	24.00 to 25.50
Zinc, E. St. Louis, Ill.	7.10 to 7.12½











Personal

John W. Boywid has resigned as superintendent of the malleable foundry of the McCormick works of the International Harvester Co., Chicago.

William S. Milne has been appointed general superintendent of the Massey-Harris Harvester Co. plant at Batavia to succeed Percy E. Verity who has been transferred to Brantford, Ont., as general superintendent of the principal plant of the company. Mr. Milne has been assistant superintendent of the Toronto, Ont., plant for six years.

Connecticut Foundrymen Hold Election

Frederick W. Stickle, president of the Capitol Foundry Co. of Hartford, Conn., was elected president of the Connecticut Foundrymen's association at the annual meeting held last week at Hartford. Carl S. Newman of the Union Mfg. Co., New Britain, Conn., was elected secretary, and George H. Holmes, McLagon Foundry Co., New Haven, Conn., was elected treasurer.

Philadelphia Association Elects Officers

Walter Wood, president of R. D. Wood & Co., Philadelphia, was elected president of the Philadelphia Foundrymen's association at a meeting held June 9. He at once assumed his new duties. Mr. Wood was one of the founders of the association and he has been chairman of its executive committee ever since the organization 35 years ago.

Oliver Smalley, 2011 Grand Central terminal, New York, addressed the meeting on various phases of the metallurgy of bronze and cast iron. Mr. Smalley believes that foundrymen would get better results in their shops if they gave more attention to molding sand. He told in considerable detail of various bronze and brass alloys which may be used as substitutes for each other.

C. F. Hopkins, second vice president of the Ajax Metal Co., was elected vice president of the Philadelphia Foundrymen's association. Walter Wood was re-elected chairman of the directors. Other directors were elected as follows: Frederick M. Devlin, Philadelphia Hardware & Malleable Iron Co., C. R. Spare, Janney Cylinder Co., H. M. Giles, Westinghouse Electric & Mfg. Co., B. H. Johnson, Cresson-Morris Co., R. R. Belleville, Joseph Dixon Crucible Co. and W. L. Kalbach, manufacturer of wooden and metal patterns. Howard Evans again was re-elected secretary of the association.

EquipmentManufacturers Meet in Cleveland

The thirty-sixth meeting of the Foundry Equipment Manufacturers' association was held at the Hotel Cleveland, Cleveland, Tuesday, June 22. Reports of business conditions, which were presented at the meeting, indicated that the foundry equipment industry is active at the present time. Many manufacturers reported that their plants are being operated as high as from 80 to 85 per cent of capacity.

One feature of the business transacted by the organization was the perfection of arrangements for the formation of a special group of crane manufacturers which will function within the association. Among those now included in this group are the Whiting Corp., Harvey, Ill.; the Shephard Electric Crane & Hoist Co., Montour Falls, N. Y.; the Northern Engineering Works, Detroit; the Harnischfeger Corp., Milwaukee; and the Cleveland Crane & Engineering Co., Wickliffe, O.

An interesting address was presented by W. H. Colston, vice president and general counsel of the Nickel Plate railroad, Cleveland, on "The Earnings of the Railroads and Their Relation to Transportation Efficiency." Another extremely interesting address was presented by J. B. Courshon, National Traders Finance Co., Chicago, on "Financing Machinery Sales."

The next event on the association calendar will be the annual banquet at Detroit, Sept. 27.

Cast Large Roll Housing

What is said to be the largest blooming mill in the world recently has been completed by the United Engineering & Foundry Co., Pittsburgh, at its Youngstown, O., plant. The entire mill is of massive construction throughout, and with the exception of a few minor parts, the castings are made of steel. The housing required was so large that it was impossible to cast it in one piece. Therefore, it was designed as a built-up housing and cast in sections, consisting of four posts, a top and a bottom separator. The total weight of the assembled housing is 353,000 pounds.

Obituary

W. H. Kelly, president of the Kelly-Cohen Foundry Co., Canton, O., died at his home June 8.

William J. Donaldson, formerly, a member of the firm of the Donaldson Iron Co., Emaus, Pa., died recently at the Methodist hospital, Philadelphia, at the age of 65. His death followed a stroke of paralysis. Mr. Donaldson was educated at the Episcopal academy and the University of Pennsylvania, after which he became associated with his father, John D. Donaldson, at the iron plant. Later he founded the Alpha Cement Works.

Camille Cavallier, long an outstanding figure in the French metallurgical industry and president of the Societe Anonyme des Hauts-Forneaux & Fonderies de Pont-a-Mousson, Nancy, France, died there June 10. Mr. Cavallier was born in 1853 and started his career in the year 1873 as assistant to Mr. Roge, founder of the then small foundries at Pont-a-Mousson. He became chief engineer of the company and upon Mr. Roge's retirement was made general manager and sole director of the company. Mr. Cavallier was a member of the board of directors of many of the leading French industries and mining companies. He was an officer of the Legion d'Honneur, Honorary president of the chamber of commerce of Nancy, and in 1924 received the gold medal awarded by the French republic for the best services rendered the country in the export trade. He has written many books regarding metallurgical, mining, economical and financial questions.

Foundrymen Meet

Robert H. Watson, metallurgist of the Semet-Solvay Co., Detroit, addressed the members of the Buffalo Foundrymen at a meeting held Wednesday evening, June 9, on the history and practice of by-product coke manufacture. Peter J. Krenz, works manager of the Buffalo Foundry & Machine Co. talked on the International Foundry congress to be held in Detroit in September. He also described his recent visit to Europe. The next meeting of the organization will be held in September.

A. &. F. Brown Co., foundry and machine work, 79 Barclay street, New York, has moved its stockroom and sales offices to the general offices at Elizabeth, N. J.

Discuss Standardization

A special survey for reduction of varieties of radiators was voted at a meeting held at Washington, June 18. The meeting was attended by representatives of about 90 per cent of the country's production and officials of the department of commerce.

Representatives of some companies said 75 per cent of their business comes from five or less sizes while some items run as low as three-tenths of 1 per cent of total demand. New types of radiation, it was said, may complicate sizes and make conditions chaotic.

As a result of the meeting a motion was adopted asking the National Boiler and Radiator Manufacturers' association to conduct a survey of varieties to be submitted for action at a later conference.

Organize Steel Foundry

The Alloy Cast Steel Co., Marion, O., recently was organized by John D. Owens, C. A. Owens, M. C. McMeil, H. J. Barnhadt, Frank D. Glosser, Walter A. Dorsey and E. J. Schoenlaub, all of Marion. The company has purchased the electric steel foundry of the Fairbanks Steam Shovel Co., Marion, which recently was sold at a receivers sale. The plant is being overhauled and enlarged to a capacity of 400 tons of steel castings per month.

Occupy New Plant

The Ajax Electrothermic Corp., Trenton, N. J., recently moved into its new plant at Ajax Park, where manufacturing facilities are increased greatly. In addition to the line of furnaces previously manufactured by this company, laboratory furnaces of a smaller type and larger furnaces for melting, heat treating and annealing also will be built. The company also will manufacture alloys, both ferrous and nonferrous, for special purposes.

Plan Symposium

A symposium on materials for use under extreme conditions will be held in connection with the October meeting of the American Electrochemical society. At the symposium, papers will be presented on materials suitable for resisting extreme conditions and on extreme conditions not yet filled in the fields of corrosion, high temperatures, refractories, electrical insulation, chemical manufacture, etc. It is desired to supplement these papers by a compilation of a list of needs for super materials, briefly stated, and of super materials already satisfactorily developed for exacting needs.

Suggestions for items either on "super materials" or "super needs" to be included in this compilation and thus brought up for discussion will be received by H. W. Gillett, bureau of standards, Washington.

Veterans Meet

The Veterans' association of the Farrel Foundry & Machine Co., Ansonia, Conn., recently held its annual dinner, and was addressed by Charles F. Bliss, president of that company. The association is composed of 121 employes who have been with the company 25 years or more. Only 31 of this number are pensioners and the average length of service of the members is 33 years.

A. Milton Buck has become connected with the sales department of the Bridgeport Brass Co., Bridgeport, Conn. Mr. Buck will be located in Washington and will represent the company in the states of Maryland, Virginia and West Virginia, specializing in valves and brass pipe.

Foundrymen Inspect Blast Furnace

Although in blast previously, the new furnace of the Hudson Valley Coke & Products Corp., Troy, N. Y., was cast officially June 5, when about a hundred foundrymen visited the plant and watched the morning cast. Later the guests were taken to an old fashioned clambake. The inspection and general opening celebration were given by E. Arthur Tutein, Inc., New York, sales agent for the Hudson Valley company.

Textbook To Be Issued

Training for foremen will be the subject of a textbook to be prepared under the direction of the educational committee of the National Metal Trades association, according to action recently taken at a committee meeting at Springfield, Mass. The association already has prepared and placed in practice a system of apprentice training.

Foundry Association Directory

The Buffalo Foundrymen
Buffalo

President, J. McARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings the third Wednesday of the month at 146 Chandler street.

Chicago Foundrymen's Club
Chicago

President, CHARLES L. LARSEN, Armour Institute of Technology, 3200 Federal street, Chicago; secretary-treasurer, E. C. BARRINGER, THE FOUNDRY, 1147 Peoples Gas building, Chicago. Meetings second Saturday in each month at the City Club, 315 Plymouth court.

Detroit Foundrymen's Association
Detroit

President, ROBERT G. CRAWFORD, Atlas Foundry Co., 131 South Artillery street, Detroit; secretary, RUSSELL M. SCOTT, Packard Motor Co., 1580 East Grand boulevard, Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

Metropolitan Brass Foundry Association
New York

President, THOMAS HARPER, Thomas Harper, 204 Lafayette street, New York; secretary, WM. E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meetings second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

President, J. L. CARTER, Barlow Foundry, Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meetings called by president.

New England Foundrymen's Association

President, H. P. BLUMENAUER, Arcade Malleable Iron Co., Worcester, Mass.; Secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio State Foundrymen's Association

President, WALTER L. SEELBACH, Walworth Run Foundry Co., 2488 West Twenty-seventh street, Cleveland; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Cleveland.

Philadelphia Foundrymen's Association
Philadelphia

President, WALTER WOOD, R. D. Wood & Co., Philadelphia; secretary, HOWARD EVANS, J. W. Paxson Co., Luzerne and D street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association
Pittsburgh

President, WILLIAM K. FRANK, Damascus Bronze Co., South avenue, N. S. Pittsburgh; secretary-treasurer, WM. J. BRANDT, Wm. J. Brandt, Bessemer building, Pittsburgh. Meetings on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association
Davenport, Iowa

President, J. H. DIEDRICH, Blackhawk Foundry & Machine Co., Davenport, Iowa; secretary-treasurer, A. D. ZIEBARTH, Davenport Foundry & Machine Co., Davenport, Iowa. Meetings the third Monday evening of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Southern Metal Trades Association
Atlanta, Ga.

President, GEORGE B. COCKER, Gastonia, N. C.; secretary-treasurer, W. E. DUNN Jr., Healey building, Atlanta, Ga. The 1926 convention to be held at Macon, Ga., the date to be announced later.

Tri-City Technical Council
Moline, Ill.

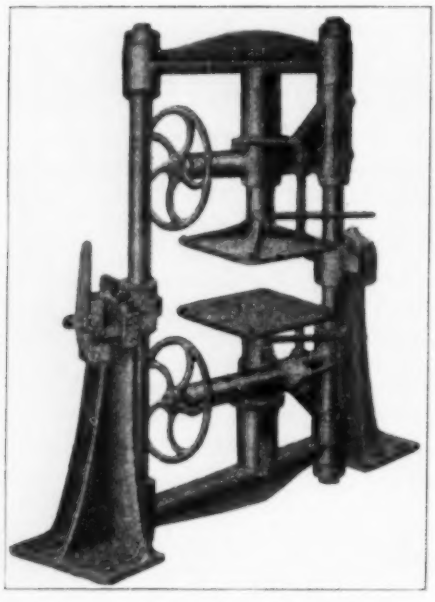
Chairman, H. BORNSTEIN, Deere & Co., Moline, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association
Cincinnati

President, HAROLD P. RITTER, John A. Oberhelman Foundry Co., 3323 Colerain avenue; secretary, GEORGE W. PIEHL, Wessling Bros. Foundry Co., 1607 McLenn avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association
Minneapolis-St. Paul

President, J. A. TEACH, Minneapolis Steel & Machinery Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, So., Minneapolis. Meetings monthly at the Athletic club.



THE HAND OPERATED MACHINE IS BUILT FOR LIGHT WORK

French Company Builds Molding Machine

A new type of molding machine has been introduced by L'Outillage de Fonderie, Paris, France, which is known as the double, radial and reversible machine. The machine, which is designed especially for small and medium-sized foundries manufacturing comparatively light castings, is hand-operated. For heavy molds the machine can be operated by air, by electricity, or hydraulically.

The frame of the machine is two cast iron cross-sections fixed to two steel columns. Each of these columns bears a spindle placed at a distance from the ground enabling the frame to rotate in the vertical plane. The spindles are supported by two heavy uprights fixed on the ground by wide bases. One of the two columns serves as axis to two arms which may rotate in the horizontal plane. The arms themselves are each connected with a table, and these two tables can move up and down by the action of a rack and pinion drive connected with a plunger and controlled by a handwheel fixed at the extremity of each arm.

The operation of the machine is as follows: The frame is locked. The two parts forming the pattern plate are fixed respectively on each table by a locking system. The box is fixed on the lower table and filled with the quantity of sand necessary for one half-mold. A wooden or aluminum bottom board is placed on the surface of the sand. This board is open in the center so that the upper pattern plate may pass through during the squeezing. The squeezing is effected by the upper table and is controlled by the handwheel. Extra pressure is obtained by the action of a horizontal lever which operates a helicoidal nut.

The frame then is unlocked and is made to rotate 180 degrees. The frame is locked in its new position, the upper table having taken the place of the lower table and vice versa. By loosening a pawl the lower plunger is liberated and works gently downward, together with the box, while the pattern plate remains fixed on its table which now is on top. The mold is thus drawn from the pattern plate. The box and the bottom board are taken off and the second part of the pattern plate then can be used in the same manner as described above for making the second half of the mold.

Combined Woodworking Machine Introduced

The Parks Ball Bearing Machine Co., Knowlton and Fergus streets, Cincinnati, recently has introduced a combination machine applicable to the pattern shop, which is shown in the accompanying illustration. The saw table is cast iron, one piece 19 x 36 inches and of ribbed construction. It is hinged on the back and is raised and lowered by a hand wheel and screw elevating device. A channel is planed on top of the mitre cut-off gage. The circular saw and the jointer are on separate mandrels enabling separate operation of either. Mandrels are threaded on outer ends to permit the fixing of attachments easily, such as molding heads, groover and dado saws. Pulleys of the saw and jointer mandrels are located at the center of the machine between the jointer table and the saw table. Rip and crosscut saws 8 inches in diameter are supplied which will cut to a depth of 1½ inches. The jointer is of the safety cylinder type, supplied with chip breakers and high speed knives 6 inches long. The front bed plate is 18 inches long and adjustable for depth of cut on machined inclines operated by one screw. An adjustable tilting fence is supplied for beveling, chamfering, etc. The frame is built of 1½-inch angle steel which is riveted and welded.

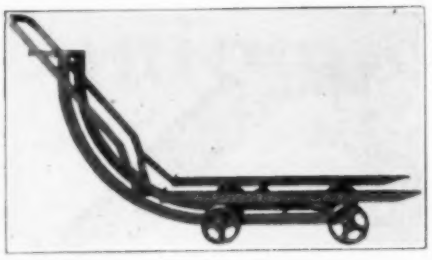
The band saw operates over cast wheels 16 inches in diameter, which are covered with a rubber band. The upper wheel has a swivel and tilting adjustment for aligning the blade and a compression spring for regulating the tension. The support arm is cast iron rigidly bolted to the frame. Safety guards are provided for the band saw, jointer and circular saw. The machine is powered by a ¾-horsepower motor which is bolted to the frame.

THE SAW TABLE IS CAST IRON, ONE PIECE AND OF RIBBED CONSTRUCTION

Open Canadian Office

Frederic B. Stevens Co., Detroit, has formed the Frederic B. Stevens, Ltd., with an office and warehouse at 139 Royce avenue, Toronto, Can. This firm also will represent the Quigley Co. of Canada, manufacturer of furnace refractories.

Sullivan Machinery Co., Chicago, has removed its Knoxville, Tenn., office from 614 Market street to 623 Market street. E. L. Thomas is manager of this office.



A HYDRAULIC RELEASE CHECK IS USED TO PREVENT JAR AND STRAIN

Designs Lift Truck

A 1-ton lift truck now is being marketed by the Arcade Mfg. Co., Freeport, Ill. The truck, which is shown in the accompanying illustration, consists of a frame shaped in the form of an elbow, as may be noted in the accompanying illustration, which carries the axles for four wheels 6 inches in diameter and 1⅞ inches in width. The lifting platform is drawn upward by a frame handle actuated by the operator. A hydraulic release check is provided so that the load may be lowered without jar or strain on the truck or its mechanism. The truck is 62 inches long and 17 inches wide. The height of the platform when raised is 7⅝ inches and the amount of elevation is 1⅝ inches. The wheel base is 19 inches and the truck weighs 100 pounds.

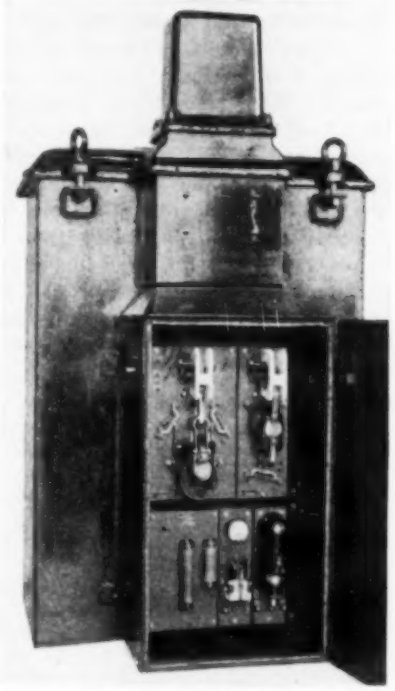
New Torch Described

In the June issue of *General electric Review* a special cutting torch, designed to use illuminating gas and shown in the accompanying illustration was described. The departure from the regulation cutting torch is in the superheating coils by which the gases may be raised to a high temperature. It is claimed that this feature increases the speed of preheating and reduces the amount of oxygen used. The torch design is a result of a study carried on at the Schenectady, N.Y., plant of the General Electric Co. Economical cutting costs are claimed to result from the use of illuminating gas and this superheating torch in the metal-working field.

Introduces Synchronous Motor Control

The Electric Controller & Mfg. Co., 2700 East 79th street, Cleveland, has developed a self-contained, oil-immersed automatic starter for 2300 volt synchronous motors. The starter is built for across the line starting of slow speed motors and for reduced voltage starting of the higher speed motors. In each case the operator simply pushes a button to start the motor and as the motor approaches synchronous speed, the field excitation is applied automatically.

The reduced voltage starter consists of a welded boiler plate tank with an automatic double-throw switching mechanism, a power transformer for providing starting voltage, potential transformers for providing 220 volts for the master switch operating current and the current limit transition relay, which connects the motor to full voltage when it has accelerated to approximately 85 per cent of synchronous speed of the electric motor.



THE UNIT IS SELF CONTAINED AND OIL IMMERSED

A field switching mechanism, field discharge register, timing relay and direct current field ammeter are enclosed in a dustproof steel cabinet on the outside of the tank. This cabinet also may contain an automatic starter for operating a magnetic clutch.

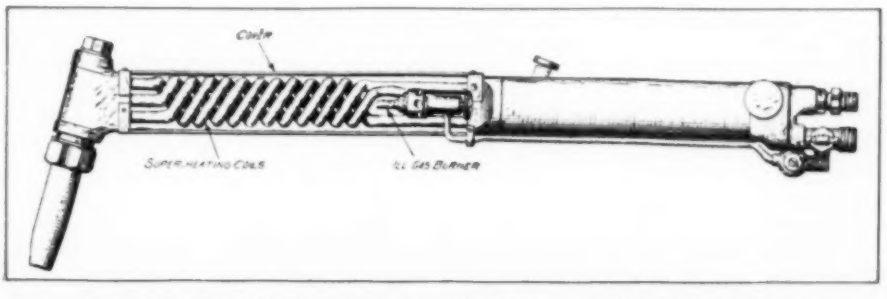
THE MACHINE IS TURNED UPSIDE DOWN AND THE GAS TURNED ON

Uses Powder and Gas To Stop Fires

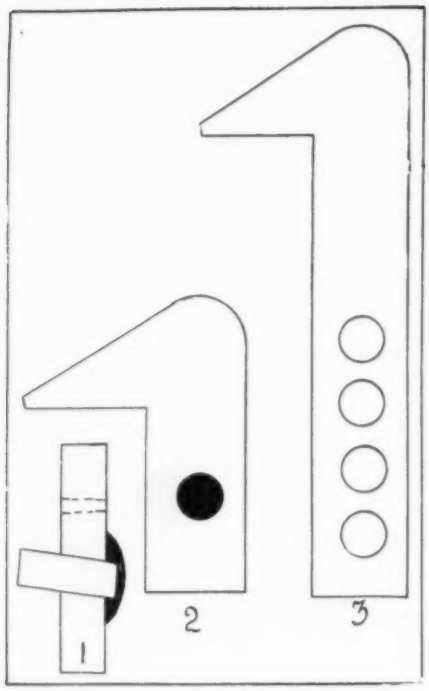
A special device for extinguishing fires recently has been introduced by the Bastian Blessing Co., 240 East Ontario street, Chicago. This device, which is shown in the accompanying illustration, consists of two units, namely a cone filled with a special powder and a cylinder which is filled with carbonic gas. A wall bracket is supplied with each machine so that it may be hung up in a convenient place.

To put out a fire, the machine simply is turned upside down and the valve of the gas cylinder opened. The resulting stream of powder and gas forms a blanket to smother the flame. The powder is projected through the nozzle in a stream which has an effective range of 25 feet. The machine may be used repeatedly until the supply of powder and gas is exhausted.

A. E. Hitchner, affiliated with the East Pittsburgh, Pa., headquarters of the Westinghouse Electric & Mfg. Co., will become manager of the company's Los Angeles office, the position having been made vacant by the recent resignation of K. E. van Kuran.



SUPERHEATING COILS RAISE THE GAS TO A HIGH TEMPERATURE



THE CLAMP IS IN TWO PIECES WITH A STEEL PIN IN ONE PART AND A ROW OF HOLES SPACED ONE INCH APART IN THE OTHER

Makes Adjustable Clamp

By Robert E. Masters

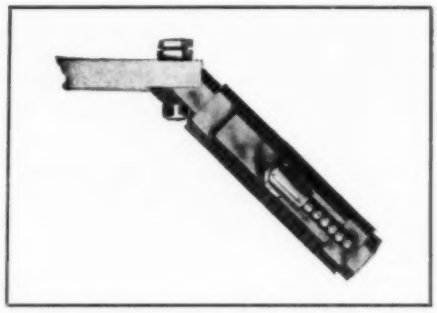
About 50 years ago I had charge of a foundry and machine shop where quite a force of skilled mechanics constantly was employed. Many of the castings were in the medium and heavy weight class required around rolling mills and blast furnaces. Delay sometimes experienced in finding clamps for many of the flasks induced the development of the adjustable clamp shown in the corresponding illustration.

The part shown in Fig. 3 was cast in two standard lengths with either four or six 5/8-inch holes cast through them close to the plain end and about 1-inch apart. The second part of the clamp shown in Fig. 2 carried a short length of ½-inch steel pin. A longitudinal section of this part is shown in Fig. 1 with the pin slightly inclined toward the end. The molders adopted the clamp quite readily. It could be adjusted almost instantly to fit almost any flask and the slight inclination of the pin prevented the two parts from slipping apart. The clamp saved a lot of time and trouble formerly encountered in hunting for blocks and wedges. At that time a skilled molder was ambitious to show how much and not how little he could do for a day's work. The loss on this clamp from breakage was almost negligible and the clamps easily were made in the foundry.

Develop Rig for Making Manhole Castings

By W. K. Smith

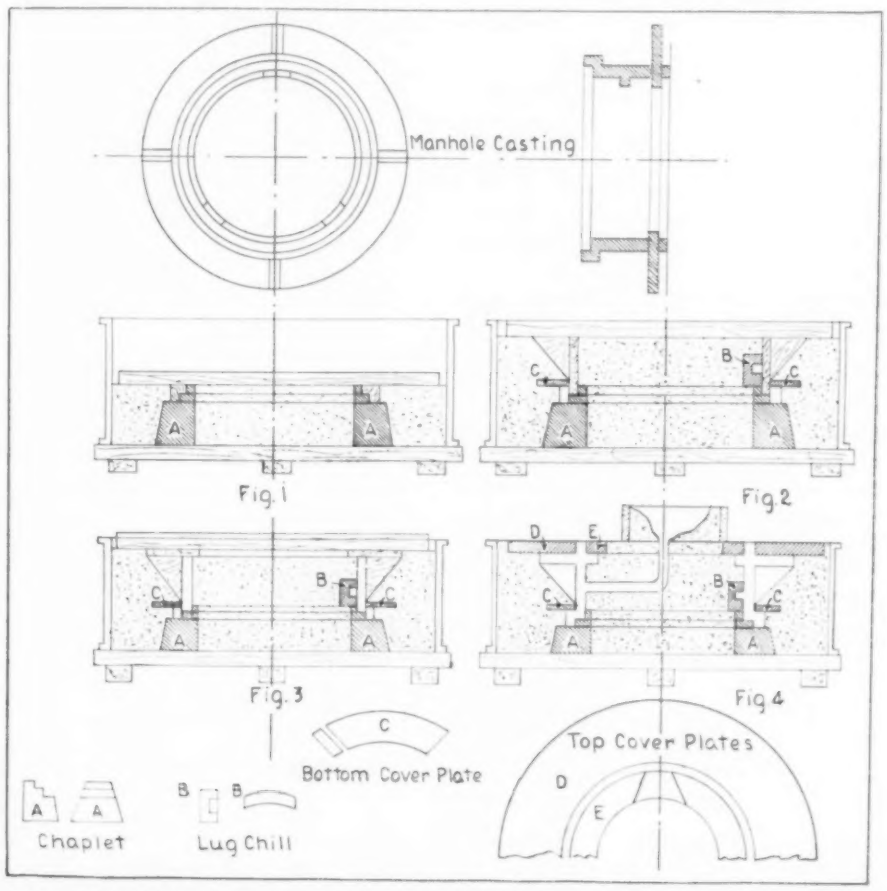
Necessity of using cores or a cope or of rolling the drag is avoided in the method adopted for making the manhole casting shown in the accompanying illustration. The pattern is made in three sections and is designed to be molded in the opposite position to that occupied later by the casting. The different steps in making the mold are shown consecutively in Figs. 1, 2, 3 and 4. The first section of the pattern is adjusted on six cast iron supports *AA* which in turn rest on the bottom board. Sand is rammed under and around this part of the pattern and then is struck off flush to form a seat for the cover plates *C*. The second, or ring section of the pattern is adjusted in place as shown in Fig. 2. The cover cores are placed on the outside and three chills *B* are spaced around the inside to form lugs. Sand then is rammed around the pattern inside and outside up to the top and is struck off flush with the top to form a seat for a wide flange. Sand is tucked around the inside and outside of the flange although not necessarily to the top. The impression of this flange merely serves for a guide in setting the cover plates. After the pattern is removed the cover plate is lowered into place and the runner basin is made up.



THE VIBRATOR OPERATES AT AN ANGLE TO THE PLATE

Develops New Vibrator

The Malleable Iron Fittings Co., Branford, Conn., recently has developed a vibrator of the springless type applicable to foundries using plates or vibrator frames or vibrators mounted on pattern or mold boards. The vibration is imparted to the plate or pattern in a semihorizontal and vertical direction, as may be noted in the above illustration. The device is made of hardened and ground steel.



FOUR SUCCESSIVE STEPS IN MOLDING A MANHOLE CASTING ARE SHOWN IN FIGS. 1, 2, 3 AND 4. DETAIL OF CHAPLETS AND COVER PLATES IS SHOWN IN THE LOWER PART OF THE ILLUSTRATION

Equipment Buying Slackens

Slump in Equipment Sales Is Appearing in Several Market Centers—Volume of Sales Declined Slightly in May

DECLINE in the volume of sales of foundry equipment, which usually is noted during the summer months, again is in evidence. In the Cleveland territory, sales in June did not equal the total in May, and men of the trade do not anticipate any great improvement in July.

Inquiries are better in the greater Pittsburgh area, but sales continue to lag. A number of propositions for cupolas, core ovens and similar equipment which have been current for several weeks, continue to be held up, with little indication that the purchases will be made soon. The Westinghouse Electric & Mfg. Co. has put out its third quarter list of equipment needs for the foundry at East Pittsburgh.

Reflecting seasonal conditions, equipment demand in the eastern district is slack. Little pickup is expected before the middle of July, or until after the inventory season. This condition probably arises from the fact that foundries are operating at a low point, this being especially true of plants specializing in railroad work. Among the new foundry projects noted is a $30,000 foundry for Schneider-Bowman Co., Philadelphia. Foundry demand for cranes and other conveying equipment, as well as melting units, appears particularly slack.

Foundries in New England seem to be out of the equipment market, and except for a few scattered sales of various items, the market has been quiet during the past two weeks.

Following completion of buying against a majority of spring building programs, foundry equipment buying in the Chicago market is only fair. One manufacturer of sand preparing equipment reports a slump in inquiries during the past two weeks but another has received an unusual number. Business in the first half of June exceeded the sales for the first half of May and many manufacturers expect the first half of the year to be well ahead of the corresponding period in 1925.

Sales of foundry equipment in May declined 2 per cent compared with April and gained 22 per cent over May last year, according to a recent report of the Foundry Equipment Manufacturers' association. The sales in May totaled $425,638 as compared with $434,626 in April and $332,125 in May, 1925. Shipments for the month of May were valued at $415,082 as compared with $402,494 in April and $407,202 for May a year ago. Orders on hand June 1 were valued at $524,382 as compared with $506,214 on May 1 and $463,431 on June 1, 1925. Orders on hand June 1 were 14 per cent higher than at the corresponding date a year ago.

PITTSBURGH MARKET

Cranes

Hyde Park Foundry & Machine Co., Hyde Park, Pa., 25-ton crane from the Cleveland Crane & Engineering Works, Wickliffe, O.

Clark Bros. Co., Olean, N. Y., one 15-ton crane; from the Harnischfeger Corp., Milwaukee.

Dust Arrester Equipment

Pittsburgh Plate Glass Co., Ford City, Pa.; from the Pangborn Corp., Hagerstown, Md.

Molding Machines

Franklin Valve & Engine Co., Franklin, Pa., two; William A. Page Boiler Co., Meadville, Pa., one rollover type; from the Herman Pneumatic Machine Co., Zelienople, Pa.

Sand Blast Equipment

Pittsburgh Plate Glass Co., Ford City, Pa.; from the Pangborn Corp., Hagerstown, Md.

Early Foundry Co., Dickson City, Pa.; from the J. W. Paxson Co., Philadelphia.

Sand Preparing Equipment

Floyd-Wells Co., Royersford, Pa., sand separator and blender; from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

Tumbling Barrels

Norristown Foundry Co., Norristown, Pa., tumbling barrel equipment, from the J. W. Paxson Co., Philadelphia.

CLEVELAND MARKET

Dust Arrester Equipment

Robbins & Myers Co., Springfield, O.; from the Pangborn Corp., Hagerstown, Md.

Molding Machines

Cadillac Motor Co., Detroit, one stationary sand throwing type; Parkersburg Rig & Reel Co., Parkersburg, W. Va., one tractor sand throwing type; from the Beardsley & Piper Co., Chicago.

Sand Blast Equipment

Electric Auto-Lite Co., Fostoria, O.; from the W. W. Sly Mfg. Co., Cleveland.

Robbins & Myers Co., Springfield, O.; John Knapp Sons Foundry Co. Akron, O.; from the Pangborn Corp., Hagerstown, Md.

Sand Preparing Equipment

Roberts Brass Mfg. Co., Detroit; sand separator and blender, from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

Shakeout Equipment

Henry Furnace Co., Medina, O., shakeout bails; Humphries Mfg. Co., Mansfield, O., vibrator and shakeout equipment, from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Miscellaneous

Agricola Furnace Co., Gadsden, Ala., resin mill; from the W. W. Sly Mfg. Co., Cleveland.

CHICAGO MARKET

Core Ovens

Kohler Co., Kohler, Wis., one continuous conveyor type; from Young Bros., Detroit.

Cranes

Western Electric Co., Chicago, gantry crane.

Dust Arrester Equipment

Koken Co., St. Louis; the Oakland Motor Car Co., Pontiac, Mich.; from the W. W. Sly Mfg. Co., Cleveland.

International Harvester Co, Rock Island, Ill.; from the Pangborn Corp., Hagerstown, Md.

Molding Machines

Standard Sanitary Mfg. Co., Chicago, two sand throwing type; Standard Foundry Co., Chicago, one stationary sand throwing type; International Harvester Co., Chicago, two tractor sand throwing type; Koken Co., St. Louis, one tractor sand throwing type; from the Beardsley & Piper Co., Chicago.

Mt. Vernon Car & Mfg. Co., Mt. Vernon, Ill., one; Dedman Foundry & Machine Co., Houston, Tex., one; the Josam Mfg. Co., Michigan City, Ind., one; the Pullman Car & Mfg. Co., Fullman, Ill., one; from the Herman Pneumatic Machine Co., Zelienople, Pa.

Sand Blast Equipment

Koken Co., St. Louis; Apex Bronze & Brass Works, Oakland, Calif.; from the W. W. Sly Mfg. Co., Cleveland.

Crane Co., Chicago; the International Harvester Co., Rock Island, Ill., from the Pangborn Corp., Hagerstown, Md.

A. J. Lindemann-Hooverson Co., Milwaukee; from the J. W. Paxson Co., Philadelphia.

Shakeout Equipment

Motor Castings Co., Milwaukee, shakeout bails; Wilson Foundry & Machine Co., Pontiac, Mich., Columbia Sanitary Mfg. Co., Louisville, Ky.; Pullman Car & Mfg. Co., Pullman, Ill., vibrator and shakeout equipment; from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Tumbling Barrels

Liberty Brass Co., San Francisco, sand blast barrel equipment; from the J. W. Paxson Co., Philadelphia.

Miscellaneous

Anderson Stove Co., Anderson, Ind., cinder mill; from the W. W. Sly Mfg. Co., Cleveland.

NEW YORK MARKET

Cranes

M. W. Kellogg Co., Jersey City, 20-ton crane trolley.

Dust Arrester Equipment

Columbia Iron Foundry, Philadelphia; Wildman Mfg. Co., Norristown, Pa., from the Pangborn Corp., Hagerstown, Md.

Furnaces

Barnett Foundry & Machine Co., Irvington, N. J. cupola equipment; from the J. W. Paxson Co., Philadelphia.

Molding Machines

A Weiskittle & Sons, Baltimore, two special bath-tub machines; Florence Pipe Foundry & Machine Co., Florence, N. J., two special pipe machines; from the Herman Pneumatic Ma-

chine Co., Zelienople, Pa.

Sand Blast Equipment

Columbia Iron Foundry, Philadelphia; Geo. R. Webster Foundry Co., Baltimore; the Baltimore & Ohio Railroad, Baltimore; from the Pangborn Corp., Hagerstown, Md.

Foran Foundry Co., Flemington, N. J.; Eastern Steel Casting Co., Newark, N. J.; Raritan Radiator Co., Raritan, N. J.; sand blast equipment from the J. W. Paxson Co., Philadelphia.

Sand Preparing Equipment

Taylor & Co., Brooklyn, N. Y.; Robins Conveying Belt Co., Passaic, N. J., sand separator and blender; from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

M. W. Kellogg Co., Jersey City, N. J., sand mixer; from the National Engineering Co., Chicago.

Shakeout Equipment

Foster-Armstrong Co., East Rochester, N. Y., shakeout bails; from the Stoney Foundry Engineering & Equipment Co., Cleveland.

NEW ENGLAND MARKET

Ladles

Bradley & Hubbard Mfg. Co., Meriden, Conn., one overhead switch 4000 pounds capacity and parts for pouring device; from Whitehead Bros., Providence, R. I.

Molding Machines

Rhode Island Malleable Iron Co., Hillsgrove, R. I., 12 jar squeezers; Union Metal Co. Chelsea, Mass., one jar squezer and one jar stripper; from the Tabor Mfg. Co., Philadelphia.

Sand Blast Equipment

Crosby Steam Gage & Valve Co., Boston; the Thomann Bronze & Brass Foundry, Inc., Medford, Mass.; from the Pangborn Corp., Hagerstown, Md.

Sand Preparing Equipment

Builders Iron Foundry, Providence, R. I.; General Electric Co., West Lynn, Mass.; Westinghouse Electric & Mfg. Co., Springfield, Mass., sand separators and blenders from the Royer Foundry & Machine Co., Wilkes-Barre, Pa.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Anderson Stove Works, Anderson, Ind., is building additions to its plant.

Lund Foundry Co., South Main street, Gardner, Mass., will build a 1-story foundry 50 x 80 feet.

Ideal Casting Co., 752 Eddy street, Providence, R. I., will build a 1-story foundry on Public street.

Northwestern Malleable Iron Co., 756 Park avenue, Milwaukee, is planning to build an addition to its annealing plant 60 x 70 feet.

Atlas Steel Casting Co., 1963 Elmwood avenue, Buffalo, is considering plans for rebuilding its burned pattern shop.

East Joplin Foundry Co., 1201 North street, Joplin, Mo., Dewey Reed president, will rebuild its burned plant.

Springfield Aluminum Plate & Castings Co., Springfield, O., E. A. Parker president, has had plans made for a foundry and machine shop addition.

Pacific States Cast Iron Pipe Co., Ironton, Utah, being organized by J. R. McWayne, Birmingham, Ala., has plans for a pipe foundry.

Stringer Bros. Inc., Gadsden, Ala., will build foundry in East Gadsden, first of four units 200 x 200 feet, to manufacture soil pipe and plumbing specialties.

Apex Brass & Bronze Works, New York, has been incorporated with $5000 capital by D. Hyman, and E. Buchman. G. J. Brownstein, 186 Joralemen street, Brooklyn, is attorney.

Abrasive Machine & Foundry Co., Cleveland, has been incorporated with $100,000 capital by E. W. Hayden, L. L. Robertson, Joseph Lustig, E. J. Hinz and Merl H. Champ.

Cook Bros. Foundry Co., Winchester, Ind., is having plans sketched for a gray iron foundry 50 x 80 feet for construction in fall or spring.

Reading Knob Works, Reading, Pa., Charles L. Reizman president, is having plans made for a 1-story brass foundry 70 x 80 feet at Gregg and Angelica avenues.

Standard Foundry Co., Racine, Wis., maker of automobile and motor castings, Arthur R. Janes president, will build an addition and install electric furnace and cranes.

American Brake Shoe & Foundry Co., 505 Preble avenue, Pittsburgh, will build a 1-story foundry addition 43 x 45 feet and 29 x 39 feet.

William H. Barr, Buffalo, has been incorporated to manufacture brass castings with $100,000 capital and 3000 common no par value by W. H. Barr, W. L. Marcy and W. F. Hagedorn. Moot, Sprague, Brownell & Marcy, Buffalo, are attorneys.

Huntington Stove & Foundry Co., Huntington, W. Va., Dan A. Mossman president, First avenue and Twentieth street, is adding to its plant to enlarge production.

Sparta Foundry Co., Sparta, Mich., has been formed to succeed the Oil Stopper Piston Ring Corp. of that city, manufacturer of piston rings.

Gardner Governor Co., Quincy, Ill., is building a plant to replace one built 25 years ago. This does not represent an increase in capacity. (Noted Dec. 1.)

Kingsport Foundry & Machine Works, Kingsport, Tenn., J. B. Burger manager, will build foundry 80 x 180 feet and 40 x 80 feet and office 28 x 30 feet, removing equipment from plant bought at Marion, Va.

Schneider Bowman Co. Inc., Philadelphia, Louis Schneider president, 1612 Van Dyke street, has let contract to Paul Brosa, 2511 West Huntingdon street, for a 1-story foundry 100 x 100 feet.

Maumee Malleable Castings Co., P. H. Jones president, Woodville street, Toledo, O., has let contract to Compte-Nauman, 912 Summit street, for a 1-story addition 60 x 65 feet.

American Skein & Foundry Co., Racine, Wis., has let contract to Nelson & Co. for a finishing room for piano plate work and remodeling of other departments, for which additional equipment will be required.

Cape Girardeau Foundry Co., St. Louis, has been incorporated with $50,000 capital to operate a foundry and machine shop by Joseph Desloge, Marcel Desloge, Benedict E. White and Edward C. Breck. Ralph Kalisch, Boatmens Bank building, is attorney.

The Oakland Steel Foundry, Ford and Peterson streets, Oakland, Calif., has been organized by F. E. Done, 1505 Santa Clara avenue, Alameda, Calif., and others, and the construction of a foundry 200 by 180 feet has been started. A 1½-ton electric furnace will be installed at once. The company will specialize in steel castings.

Chemung Foundry Corp., Elmira, N. Y., manufacturer of gray iron, semisteel, nickel chromium, iron and aluminum castings, will add a brass foundry to its equipment. A foundry 160 x 210 feet is being built, part of which will be devoted to this use. It will be equipped with a traveling crane and I-beam conveyor system for pouring. John D. Ward is president, Francis X. Moser vice president and Benjamin Rathbun secretary and treasurer.

New Trade Publications

WELDED CHAIN—S. G. Taylor Chain Co., Chicago, has issued a revised general catalog containing complete data for safe loads on double sling chains at various angles.

THRUST BEARINGS—Standard Steel & Bearings Inc., Plainville, Conn., has issued data sheets of dimensions, prices and load ratings of its thrust bearings.

BELT FASTENERS—Various types of belt fasteners including tools for applying are shown in a catalog published by the Mastabar Belt Fastener Co., 14a Blackfriars street, Manchester, England.

GRATINGS AND TREADS—Grating Co. of America, Pittsburgh, has issued a bulletin giving data on safe loads for its various types of gratings and describing features of construction that make for strength.

STEEL TIES—Time saving, increased production, portability and lower headroom requirements are some of the advantages claimed for steel ties in a booklet on steel ties issued by the Bethlehem Steel Co., Bethlehem, Pa.

LUMBER—The Pickering Lumber Co., Kansas City, Mo., has issued a catalog describing its holdings, plants and equipment and products manufactured. The catalog is illustrated with many scenes from the forest to the finished product.

STEEL CASTINGS—Making Steel Castings Stronger is the title of the fourth of a series of bulletins issued by the International Nickel Co., New York. The application and results of using nickel steel in castings are given with some of the physical characteristics obtained.

PNEUMATIC MACHINES—Single and two stage compressors showing the design and characteristic features of each are given in a catalog issued by the Curtis Pneumatic Machinery So., St. Louis. Air hoists and cranes manufactured by the company also are described.